# IRON AND STEEL.

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The statistics given in this report relate only to establishments which operate blast furnaces, rolling mills and steel works, iron-ore forges, and pig and scrap iron bloomeries, establishments for the two branches last named being reported separately only when the products are intended for sale in the general market, and not for consumption in other departments of the plants by which they are produced. The products of blast furnaces embrace all kinds of pig iron, spiegeleisen, ferromanganese, and castings made direct from the furnace. The products of rolling mills and steel works embrace ingots, direct steel castings, and all rolled or hammered iron or steel made by works of this character; they also embrace bolts, nuts, nails, spikes, wire, and other highly finished products manufactured by establishments which are equipped with hot trains of rolls. In many establishments the latter products form the articles of chief value, practically all of the rolled material produced being consumed in their manufacture. The products of forges and bloomeries embrace iron blooms, billets, and hammered bar iron made directly from iron ore alone, from pig iron alone, from scrap iron, and from scrap iron and steel mixed. The ton used throughout this report is the gross ton, 2,240 pounds.

In the census for 1870, 1880, and 1890, all quantities were reported in net tons of 2,000 pounds, but as gross tons are now almost universally used in the iron and steel industry, it has been deemed advisable to adopt this weight in the present report, changing, of course, from net to gross tons in every case the figures already printed for the three preceding censuses.

The period covered by this report is the census year beginning on June 1, 1899, and ending on May 31, 1900, or the business year of the establishments reporting which most nearly conforms to and precedes this year. In the census for 1890 the period covered was from July 1, 1889, to June 30, 1890; in the census for 1880 it was from June 1, 1879, to May 31, 1880; and in the census for 1870 it was from June 1, 1869, to May 31, 1870. As in the census for 1890, this report is divided into four parts, as follows:

Part I.—The iron and steel industry as a whole.

Part II.—The manufacture of pig iron.

Part III.—The manufacture of steel ingots and steel castings and rolled iron and steel.

Part IV.—The manufacture for sale of iron blooms, billets, and hammered bar iron.

## Part I.—THE IRON AND STEEL INDUSTRY AS A WHOLE.

In the tables which follow, full and complete data will be found for the three branches of the iron and steel industry named above. The details for each of these branches are shown under their respective headings. For the New England, Middle, Southern, and Western states they are also shown as a whole and by branches as well.

Table 1 shows the capital invested, persons employed, salaries and wages paid, miscellaneous expenses, cost of materials used, and quantity and value of products in the three branches of the iron and steel industry covered by this report for 1900, 1890, 1880, and 1870. For the three periods first named active establishments only are included. For 1870 active establishments are not separated from idle establishments. The percentage of increase or decrease for each period is also shown.

[1] The writer desires to express his sincere thanks to iron and steel manufacturers generally for aid rendered him in the preparation of this report. He is under especial obligations to The American Iron and Steel Association, whose valuable records were of great assistance to him.

TABLE 1.—IRON AND STEEL: COMPARATIVE SUMMARY, 1870 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.[1]

| | DATE OF CENSUS. | | | | PER CENT OF INCREASE. | | |
|---|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880[2] | 1870[2] | 1890 to 1900 | 1880 to 1890 | 1870 to 1880 |
| Number of establishments | 669 | 719 | 792 | 808 | [3]7.0 | [3]9.2 | [3]2.0 |
| Capital | [4]$590,530,484 | [4]$414,044,844 | $209,904,965 | $121,772,074 | 42.6 | 97.3 | 72.4 |
| Salaried officials, clerks, etc., number | 9,217 | [5]4,325 | (6) | (6) | 113.1 | ..... | ..... |
| Salaries | $11,741,788 | [5]$6,462,236 | (6) | (6) | 81.7 | ..... | ..... |
| Wage-earners, average number | 222,607 | 171,181 | [7]140,798 | 77,555 | 30.0 | 21.6 | 81.5 |
| Total wages | $120,836,338 | $89,273,956 | [7]$55,451,510 | $40,514,981 | 35.4 | 61.0 | 36.9 |
| Men, 16 years and over | 219,635 | 168,943 | 133,023 | 75,037 | 30.0 | 27.0 | 77.3 |
| Wages | $120,157,007 | $88,840,642 | (6) | (6) | 35.3 | ..... | ..... |
| Women, 16 years and over | 1,071 | 58 | 45 | 82 | 1,746.6 | 28.9 | [3]45.1 |
| Wages | $266,888 | $17,106 | (6) | (6) | 1,460.2 | ..... | ..... |
| Children, under 16 years | 1,901 | 2,180 | 7,780 | 2,436 | [3]12.8 | [3]71.8 | 217.3 |
| Wages | $412,443 | $416,208 | (6) | (6) | [3]0.9 | ..... | ..... |
| Miscellaneous expenses | $32,274,100 | $18,214,948 | (8) | (8) | 77.2 | ..... | ..... |
| Cost of materials used | $522,431,701 | $327,272,845 | $191,271,150 | $135,526,132 | 59.6 | 71.1 | 41.1 |
| Value of products[9] | $804,034,918 | $478,687,519 | $296,557,685 | $207,208,696 | 68.0 | 61.4 | 43.1 |
| Tons of products[10] | 29,507,860 | 16,264,478 | 6,486,733 | 3,263,585 | 81.4 | 150.7 | 98.8 |

[1] This summary includes only active establishments for 1880, 1890, and 1900; such establishments were not reported separately in 1870. The 669 establishments in 1900 include 1 penal institution, the figures for which are not included in Parts I and II of the Report on Manufactures.
[2] For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks, page 2, Part I, Manufacturing Industries, 1890, in regard to the depreciated currency of 1870; and in regard to the inclusion of capital, employees and wages relating to mining and other operations in the figures for 1880, see page 745, Statistics of Manufactures, 1880.
[3] Decrease.
[4] Includes rented property valued in 1900 at $16,968,821; in 1890 at $8,273,058.
[5] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Tables 71, 72, and 73.)
[6] Not reported separately.
[7] Does not include 180 employees and $25,275 wages reported by an idle establishment in Minnesota, and included in the totals published at the census of 1880. These employees were engaged in making repairs to plant.
[8] Not reported.
[9] Includes value of miscellaneous products for which tonnage was not reported.
[10] Gross ton of 2,240 pounds.

Capital embraces the amount invested by iron and steel establishments in land, buildings, machinery, tools, and implements, whether owned or rented, and cash on hand, bills receivable, unsettled ledger accounts, raw materials, stock in process of manufacture, finished products on hand, and other sundries.

Salaried officials embrace all salaried officers of corporations, and general superintendents, managers, clerks, etc. In 1890 the amount drawn as salaries by proprietors and firm members is included in the $6,462,236 reported for that year, but for 1900 the amount paid to persons of this class is not included in the $11,741,788 given in Table 1; in 1900 the number of proprietors and firm members was reported, without salaries, and will be found in Tables 71, 72, and 73, but they are not included in the 9,217 salaried officials shown in Table 1.

Miscellaneous expenses comprise the amount paid for rent of works, power and heat, local taxes, rent of offices, interest, insurance, internal-revenue tax and stamps, ordinary repairs to buildings and machinery, advertising, contract work, and sundry expenses of all kinds not elsewhere reported. The amount expended for extensive repairs to buildings, for the erection of new buildings, furnaces, and the addition of new machinery is included in the amount reported for capital, and not in that for miscellaneous expenses.

In comparing the statistics for 1890 with those given for 1870 and 1880, attention was called in the census report for 1890 to the fact that the values reported for 1870 were expressed in currency which in that year was at a considerable discount in gold, the average premium on gold during the twelve months constituting the census year from June 1, 1869, to May 31, 1870, being about 25.3 per cent. A premium on gold of one-fourth is equal to a discount on currency of about one-fifth. This fact should always be borne in mind when comparing the wages paid, cost of materials, value of products, etc., in 1870, with similar data for subsequent census years, and the figures for 1870 reduced in the ratio mentioned.

The fact was also pointed out that the census statistics for 1880 included not only the capital invested in blast-furnace plants and machinery and the labor employed in the production of pig iron, but also the capital invested and labor employed in mining iron ore and coal, in coke making, in limestone quarrying, in charcoal burning, etc., when the mines, ovens, quarries, or kilns were owned or operated by establishments which also produced pig iron. The cost of materials reported was nevertheless apparently the cost at the furnace. In the figures of cost for 1880 there is, therefore, a duplication to this extent. In the census statistics for 1890 and 1900, however, the data given for the blast-furnace industry relate only to the manufacture of pig iron, and do not include details for any of the other industries named above. These important facts should not be overlooked when comparing the statistics for the different census periods covered by this report.

From Table 1 it will be seen that, while the number of establishments has decreased from 808 active and idle in 1870 to 669 active in 1900, the capital invested has increased from $121,772,074 in 1870 to $590,530,484 in 1900; the number of wage-earners, from 77,555 in 1870 to 222,607 in 1900; the wages paid, from $40,514,981 in 1870 to $120,836,338 in 1900; the cost of materials used, from $135,526,132 in 1870 to

$522,431,701 in 1900; and the value of the products, from $207,208,696 in 1870 to $804,034,918 in 1900. During the thirty years under review the tonnage of pig iron, steel castings, rolled products, hammered blooms, etc., increased from 3,263,585 gross tons in 1870 to 29,507,860 tons in 1900.

Comparing the leading details for 1900 with those for 1890, we find a decrease in the number of active establishments of 50, an increase in the capital invested in active establishments of $176,485,640, and an increase in the average number of wage-earners of 51,426. The number of men, 16 years of age and over, increased 50,692, and the number of women, 16 years of age and over, increased 1,013, but the number of children under 16 years of age employed shows a decrease of 279. The miscellaneous expenses increased $14,059,152 in 1900 over 1890, the cost of materials, $195,158,856, and the value of products, $325,347,399. In quantity, the products increased in the same period 13,243,382 tons.

Table 2 shows the number of establishments, the capital invested, the number of employees, the wages and salaries paid these employees, the cost of the materials used, and the value of products in 1900, by states, in comparison with similar details by states and territories for 1890 and 1880. In the census year 1900 there were no territories which produced pig iron or hammered bars or blooms, or manufactured rolled iron or steel.

TABLE 2.—IRON AND STEEL: COMPARATIVE SUMMARY BY STATES, 1880 TO 1900.[1]

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 1900 | 669 | [2]$590,530,484 | 9,217 | $11,741,788 | 222,607 | $120,836,338 | $32,274,100 | $522,431,701 | $804,034,918 |
| | 1890 | 719 | [2]414,044,844 | [3]4,325 | [3]6,462,236 | 171,181 | 89,273,956 | 18,214,948 | 327,272,845 | 478,687 519 |
| | 1880 | 792 | 209,904,965 | ([4]) | ([4]) | 140,798 | 55,451,510 | ([5]) | 191,271,150 | 296,557,685 |
| Alabama | 1900 | 25 | 16,091,479 | 182 | 292,861 | 7,238 | 2,454,401 | 896,126 | 10,062,094 | 17,302,483 |
| | 1890 | 35 | 17,987,583 | 198 | 319,044 | 5,685 | 2,202,964 | 1,089,690 | 7,425,344 | 12,544,227 |
| | 1880 | 8 | 2,757,196 | ..... | ..... | 1,626 | 571,713 | ..... | 601,073 | 1,452,856 |
| California | 1900 | 3 | 1,499,162 | 18 | 22,250 | 555 | 327,184 | 18,944 | 506,834 | 900,854 |
| | 1890 | 4 | 4,656,611 | 38 | 56,549 | 1,114 | 693,300 | 208,088 | 1,938,333 | 3,097,165 |
| | 1880 | 1 | 1,000,000 | ..... | ..... | 319 | 177,722 | ..... | 535,500 | 780,000 |
| Connecticut | 1900 | 8 | 4,986,147 | 74 | 109,875 | 1,828 | 959,825 | 198,067 | 2,348,411 | 4,318,431 |
| | 1890 | 13 | 2,189,521 | 41 | 55,784 | 649 | 362,405 | 96,123 | 1,324,078 | 2,037,618 |
| | 1880 | 17 | 2,557,000 | ..... | ..... | 685 | 331,184 | ..... | 1,341,225 | 1,998,698 |
| Delaware | 1900 | 6 | 4,207,079 | 81 | 132,677 | 1,490 | 705,366 | 140,054 | 1,635,762 | 3,159,641 |
| | 1890 | 7 | 2,558,865 | 53 | 78,061 | 1,037 | 765,158 | 43,201 | 1,549,539 | 2,608,670 |
| | 1880 | 8 | 1,341,469 | ..... | ..... | 867 | 344,476 | ..... | 1,214,050 | 2,347,177 |
| Georgia | 1900 | 3 | 666,916 | 18 | 13,295 | 194 | 48,391 | 8,300 | 237,421 | 391,599 |
| | 1890 | 5 | 908,243 | 18 | 23,125 | 339 | 89,045 | 52,770 | 327 728 | 471,757 |
| | 1880 | 9 | 973,800 | ..... | ..... | 1,803 | 185,489 | ..... | 631,707 | 990,850 |
| Illinois | 1900 | 26 | 43,356,239 | 780 | 926,091 | 16,642 | 9,640,716 | 8,208,240 | 41,729,261 | 60,303,144 |
| | 1890 | 24 | 34,689,919 | 179 | 269,308 | 8,685 | 5,220,883 | 793,128 | 30,089,674 | 39,011,051 |
| | 1880 | 16 | 5,795,620 | ..... | ..... | 5,253 | 2,508,718 | ..... | 14,977,145 | 20,545,289 |
| Indiana | 1900 | 27 | 14,994,210 | 205 | 266,764 | 7,579 | 4,243,831 | 376,844 | 12,438,754 | 19,338,481 |
| | 1890 | 15 | 4,099,095 | 69 | 103,013 | 2,048 | 1,151,148 | 171,548 | 3,075,056 | 4,742,760 |
| | 1880 | 12 | 2,283,000 | ..... | ..... | 2,048 | 864,921 | ..... | 3,293,073 | 4,551,403 |
| Kentucky | 1900 | 8 | 4,198,987 | 95 | 138,504 | 2,402 | 1,144,782 | 176,846 | 4,381,100 | 6,977,343 |
| | 1890 | 9 | 2,310,655 | 48 | 63,689 | 1,435 | 670,489 | 115,645 | 1,703,144 | 2,725,603 |
| | 1880 | 18 | 4,610,035 | ..... | ..... | 4,095 | 1,344,400 | ..... | 3,223,799 | 5,090,029 |
| Maryland | 1900 | 9 | 3,765,003 | 55 | 77,147 | 2,138 | 1,029,753 | 503,298 | 6,888,916 | 8,739,405 |
| | 1890 | 10 | 4,217,574 | 25 | 24,358 | 1,247 | 371,993 | 46,077 | 2,217,173 | 2,869,208 |
| | 1880 | 18 | 4,402,125 | ..... | ..... | 2,763 | 905,090 | ..... | 2,888,574 | 4,470,050 |
| Massachusetts | 1900 | 8 | 13,738,593 | 98 | 162,617 | 6,125 | 3,408,827 | 1,001,756 | 7,542,888 | 13,491,159 |
| | 1890 | 15 | 9,005,555 | 127 | 182,964 | 5,210 | 2,469,075 | 208,262 | 6,951,018 | 11,201,149 |
| | 1880 | 24 | 6,163,408 | ..... | ..... | 6,513 | 2,576,589 | ..... | 6,657,232 | 10,288,921 |
| Michigan | 1900 | 10 | 3,934,050 | 72 | 95,076 | 1,972 | 941,091 | 277,827 | 3,770,213 | 5,902,058 |
| | 1890 | 19 | 6,096,541 | 82 | 139,756 | 1,427 | 766,361 | 369,163 | 4,135,991 | 5,829,843 |
| | 1880 | 15 | 3,342,386 | ..... | ..... | 3,089 | 922,597 | ..... | 3,279,420 | 4,591,613 |
| Missouri | 1900 | 7 | 2,611,278 | 68 | 96,331 | 1,868 | 1,006,584 | 100,021 | 2,064,533 | 3,974,666 |
| | 1890 | 9 | 3,495,913 | 45 | 65,802 | 1,269 | 655,099 | 175,924 | 2,079,254 | 3,237,542 |
| | 1880 | 12 | 5,698,600 | ..... | ..... | 3,139 | 734,575 | ..... | 3,249,558 | 4,660,530 |
| New Jersey | 1900 | 25 | 20,336,609 | 332 | 497,245 | 8,288 | 3,892,941 | 1,146,984 | 16,810,425 | 24,381,699 |
| | 1890 | 28 | 11,697,362 | 146 | 238,183 | 5,150 | 2,546,791 | 639,351 | 7,031,046 | 11,018,575 |
| | 1880 | 37 | 8,764,050 | ..... | ..... | 4,792 | 1,808,448 | ..... | 6,556,283 | 10,341,896 |
| New York | 1900 | 30 | 13,292,346 | 238 | 377,988 | 5,418 | 3,062,711 | 503,558 | 7,676,155 | 13,358,553 |
| | 1890 | 44 | 16,282,435 | 186 | 301,843 | 6,848 | 3,303,811 | 877,541 | 10,424,852 | 15,849,587 |
| | 1880 | 74 | 19,752,471 | ..... | ..... | 11,444 | 4,099,451 | ..... | 18,395,229 | 22,219,219 |
| Ohio | 1900 | 107 | 86,477,552 | 1,231 | 1,592,501 | 33,677 | 19,730,469 | 4,400,859 | 91,329,307 | 138,935,256 |
| | 1890 | 101 | 37,642,887 | 620 | 864,528 | 28,546 | 13,262,141 | 2,293,068 | 44,551,301 | 65,206,828 |
| | 1880 | 103 | 22,807,606 | ..... | ..... | 20,071 | 8,265,070 | ..... | 23,997,915 | 34,918,360 |
| Pennsylvania | 1900 | 291 | 321,985,659 | 5,068 | 6,184,780 | 110,864 | 61,908,405 | 17,845,789 | 283,142,785 | 434,445,200 |
| | 1890 | 311 | 226,294,407 | 2,099 | 3,129,515 | 92,473 | 49,550,665 | 9,764,737 | 180,220,237 | 264,571,624 |
| | 1880 | 321 | 102,956,223 | ..... | ..... | 57,959 | 25,095,850 | ..... | 92,267,030 | 145,576,268 |
| Tennessee | 1900 | 16 | 5,482,665 | 96 | 118,244 | 1,979 | 589,304 | 226,365 | 3,404,154 | 5,080,624 |
| | 1890 | 15 | 4,613,355 | 85 | 118,446 | 1,472 | 657,075 | 276,869 | 2,943,671 | 4,247,868 |
| | 1880 | 29 | 2,862,826 | ..... | ..... | 3,077 | 659,778 | ..... | 1,376,059 | 2,274,208 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $16,968,821; in 1890, at $8,273,058.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary.
[4] Not reported separately.
[5] Not reported.

TABLE 2.—IRON AND STEEL: COMPARATIVE SUMMARY BY STATES, 1880 TO 1900[1]—Continued.

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| Texas | 1900 | 3 | $379,215 | 14 | $9,160 | 248 | $42,661 | $8,229 | $90,439 | $172,468 |
| | [2]1890 | | | | | | | | | |
| | 1880 | 1 | 40,000 | | | 140 | 27,720 | | 23,580 | 36,000 |
| Virginia | 1900 | 20 | 6,941,696 | 150 | 208,669 | 3,097 | 980,587 | 248,314 | 5,498,672 | 8,341,888 |
| | 1890 | 21 | 6,330,993 | 100 | 145,908 | 3,010 | 1,117,452 | 373,749 | 4,404,452 | 6,326,084 |
| | 1880 | 21 | 2,294,713 | | | 2,522 | 665,432 | | 1,496,151 | 2,585,999 |
| West Virginia | 1900 | 11 | 8,202,910 | 105 | 129,477 | 4,467 | 2,293,524 | 225,165 | 10,422,322 | 16,514,212 |
| | 1890 | 12 | 6,458,924 | 76 | 103,445 | 3,757 | 1,734,764 | 147,432 | 7,906,036 | 10,556,865 |
| | 1880 | 16 | 3,712,616 | | | 4,121 | 1,541,816 | | 3,484,625 | 6,054,082 |
| Wisconsin | 1900 | 12 | 5,918,329 | 91 | 115.449 | 1,921 | 1,216,850 | 361,571 | 5,410,066 | 8,905,226 |
| | 1890 | 9 | 6,461,531 | 30 | 50,754 | 1,890 | 981,787 | 175,405 | 4,613,753 | 6,501,761 |
| | 1880 | 8 | 2,768,218 | | | 2,153 | 1,004,931 | | 3,880,667 | 6,580,391 |
| All other states[3] | 1900 | 14 | 7,514,360 | 146 | 174,787 | 2,617 | 1,268,135 | 395,943 | 5,541,189 | 8,510,528 |
| | 1890 | 13 | 5,446,875 | 65 | 128,161 | 1,690 | 711,550 | 297,177 | 2,417,165 | 4,031,794 |
| | 1880 | 24 | 3,021,603 | | | 2,826 | 815,595 | | 2,951,255 | 4,203,901 |

[1] This summary includes only active establishments.
[2] Included in "all other states."
[3] Includes establishments distributed as follows: 1900—Colorado, 3; Kansas, 1; Maine, 1; Minnesota, 3; North Carolina, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1. 1890—Colorado, 2; Iowa, 1; Maine, 2; Minnesota, 1; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 1; Washington, 1; Wyoming, 1. 1880—Colorado, 1; District of Columbia, 1; Kansas, 2; Maine, 3; Nebraska, 1; New Hampshire, 2; North Carolina, 9; Oregon, 1; Rhode Island, 1; Vermont, 2; Wyoming, 1.

As shown above, Pennsylvania, Ohio, and Illinois were far in the lead of all other states in 1900 and 1890 in the amount of capital invested, in the number of wage-earners employed, in the amount paid for wages, in the amount expended for materials, and in the value of the products made. It may, therefore, be of interest to briefly call attention to the figures reported by each of these states for the census periods covered by the table.

Of the total capital reported for active establishments in 1900, namely, $590,530,484, Pennsylvania contributed $321,985,659, or considerably over one-half, as compared with $226,294,407 in 1890 (total, $414,044,844), still over one-half, and $102,956,223 in 1880 (total, $209,904,965), a little less than one-half. The average number of wage-earners employed in the whole country in 1900 was 222,607, who were paid wages amounting to $120,836,338. Of these totals Pennsylvania gave work to 110,864 wage-earners, almost one-half of the total reported, paying them $61,908,405, or over one-half of the wages paid in this industry in the United States.

In 1890 the average number of wage-earners reported by the state was 92,473, and for the whole country it was 171,181. In this year Pennsylvania employed considerably over one-half of the entire number reported. The amount of wages paid by Pennsylvania in 1890 was $49,550,665, as compared with $89,273,956 paid by the country at large. In 1880 the average number of wage-earners given employment in Pennsylvania was 57,952, and the wages paid amounted to $25,095,850. In the whole country the average number of wage-earners reported was 140,798, and the wages paid $55,451,510. In this year Pennsylvania employed considerably less than one-half of the total wage-earners reported, but paid those at work within its borders almost one-half of the total wages reported for the country at large.

In 1900 the cost of all materials used by iron and steel establishments, including freight charges, amounted to $522 431,701. Pennsylvania's contribution to this total was $283,142,785, considerably more than the total cost reported by all the other states in the Union. In 1890 the amount reported by Pennsylvania for cost of materials was $180,220,237, compared with $327,272,845 for the whole country, and in 1880 it was $92,267,030, compared with $191,271,150 for all the states. The value of the iron and steel products reported by Pennsylvania in 1900 was $434,445,200, compared with $804,034,918 for the United States, or 54 per cent of the total value reported. In 1890 the figures for Pennsylvania were $264,571,624, and for the whole country they were $478,687,519, Pennsylvania's contribution amounting to 55.3 per cent, slightly more than in 1900. In 1880 the value of the products made by iron and steel establishments in Pennsylvania was $145,576,268, as compared with $296,557,685 reported by the United States, the proportion of Pennsylvania being 49.1 per cent.

Of the total capital invested in 1900, Ohio, which ranked second in the manufacture of iron and steel, reported $86,477,552, as compared with $37,642,887 in 1890 and $22,807,606 in 1880. The average number of wage-earners reported was 33,677 in 1900, 23,546 in 1890, and 20,071 in 1880, the wages paid to these workers amounting to $19,730,469 in 1900, $13,262,141 in 1890, and $8,265,070 in 1880. The cost of materials, including freight charges, was $91,329,307 in 1900, $44,551,301 in 1890, and $23,997,915 in 1880. The value of the products amounted to $138,935,256 in 1900, compared with $65,206,828 in 1890 and $34,918,360 in 1880. The increase in capital invested in 1900 over 1890 was $48,834,665, and over 1880 it was $63,669,946. With regard to wage-earners, the average number employed in 1900 increased over 1890 by 10,131 and over 1880 by 13,606. The wages paid increased in 1900 over 1890 by $6,468,328. As compared with 1880, the increase in wages in 1900 amounted to $11,465,399. The cost of materials increased in 1900, as compared with 1890, $46,778,006. As compared with 1880, the increase was $67,331,392. The value of products was

$73,728,428 greater in 1900 than in 1890, and $104,016,896 greater than in 1880.

Illinois, which was third in importance in 1900 in the manufacture of iron and steel, had capital invested in that year to the amount of $43,356,239, compared with $34,689,919 in 1890 and $5,795,620 in 1880. The average number of wage-earners employed in 1900 was 16,642, compared with 8,685 in 1890 and 5,253 in 1880. The wages paid amounted to $9,640,716 in 1900, $5,220,883 in 1890, and $2,508,718 in 1880. For materials, the active iron and steel establishments in Illinois paid $41,729,261 in 1900, $30,039,674 in 1890, and $14,977,145 in 1880. The value of their products amounted to $60,303,144 in 1900, $39,011,051 in 1890, and $20,545,289 in 1880. The increase in the capital invested in 1900 over 1890 was $8,666,320, and over 1880 it was $37,560,619. Compared with 1890, the increase in wage-earners in 1900 was 7,957, and compared with 1880 it was 11,389. The increase in the wages paid in 1900 over 1890 was $4,419,833, and over 1880 it was $7,131,998. Materials in 1900 cost $11,689,587 more than in 1890 and $26,752,116 more than in 1880. The value of the products was $21,292,093 greater in 1900 than in 1890, and $39,757,855 greater than in 1880.

Combining the leading details for these three states for 1900, and comparing the totals thus reached with similar data for 1890 and 1880, the following results are obtained: Capital invested in 1900, $451,819,450, compared with $298,627,213 in 1890 (increase, $153,192,237), and $131,559,449 in 1880 (increase in 1900 over 1880, $320,260,001). Average number of wage-earners employed in 1900, 161,183, against 124,704 in 1890 (increase, 36,479), and 83,276 in 1880 (increase in 1900 over 1880, 77,907). Wages paid in 1900, $91,279,590, compared with $68,033,689 in 1890 (increase, $23,245,901), and $35,869,638 in 1880 (increase in 1900 over 1880, $55,409,952). Cost of materials in 1900, $416,201,353, compared with $254,811,212 in 1890 (increase, $161,390,141), and $131,242,090 in 1880 (increase in 1900 over 1880, $284,959,263). Value of products in 1900, $633,683,600, against $368,789,503 in 1890 (increase, $264,894,097), and $201,039,917 in 1880 (increase in 1900 over 1880, $432,643,683). The details given above show that in 1900, 76.5 per cent of the total capital reported by all active iron and steel establishments was invested in the three states named, against 72.1 per cent in 1890 and 62.7 per cent in 1880; that these states employed 72.4 per cent of the number of wage-earners reported for 1900 for the entire iron and steel industry, against 72.8 per cent in 1890 and 59.1 per cent in 1880; that they paid these wage-earners in 1900, 75.5 per cent of the total wages paid in the United States to workmen engaged in the manufacture of iron and steel, against 76.2 per cent in 1890 and 64.7 per cent in 1880; that they paid for materials in 1900, 79.7 per cent of the total cost reported by all iron and steel establishments, against 77.9 per cent in 1890 and 68.6 per cent in 1880; and that the value of the iron and steel products manufactured within their borders amounted in 1900 to 78.8 per cent of the total value reported for the country at large, against 77 per cent in 1890 and 67.8 per cent in 1880.

Ranking the remaining leading iron and steel manufacturing states according to the value of their products in 1900, New Jersey was fourth, Indiana fifth, Alabama sixth, West Virginia seventh, New York eighth, Massachusetts ninth, Wisconsin tenth, Maryland eleventh, Virginia twelfth, Kentucky thirteenth, Michigan fourteenth, and Tennessee fifteenth. In each of these states the iron and steel produced in 1900 amounted in value to over $5,000,000 but less than $25,000,000. In the same year the value of the iron and steel products of none of the other states enumerated in the table exceeded $5,000,000.

With the exception of California, Georgia, and New York, all the states named in the table increased the value of their output in 1900 compared with 1890. In California the decrease was quite marked, the value declining from $3,097,155 in 1890 to $900,854 in 1900, a loss of $2,196,301. During the same years the average number of wage-earners employed in this state fell from 1,114 in 1890 to 555 in 1900, a decrease of 559. Since the close of the census year the iron and steel industry of California has still further declined. In 1900 the value of the iron and steel produced by Georgia amounted to $391,599, compared with $471,757 in 1890, a decline of $80,158. In 1880 the value of its iron and steel products amounted to $990,850. The decline in the twenty years was, therefore, $599,251. The number of wage-earners employed decreased from 1,303 in 1880 to 339 in 1890 and to 194 in 1900, a total loss of 1,109. New York shows a very heavy decline in 1900 in the value of its iron and steel products, compared with 1880, the decrease in the twenty years amounting to $8,360,666. From 1890 to 1900 the falling off amounted to $1,990,984. The average number of wage-earners employed in 1880 was 11,444. In 1890 the number had decreased to 6,848, and in 1900 the latter number had fallen to 5,418, a loss during the two decades of 6,026.

With the exception of the three states named above, Delaware was the only state which reported a decrease in the number of wage earners employed in 1900 compared with 1890. In the year last named the number employed was 1,637, but in 1900 only 1,490 were reported, a loss of 147. During the same period, however, Delaware increased the value of its iron and steel products from $2,608,670 in 1890 to $3,159,641 in 1900, a gain of $550,971.

The ever increasing consumptive powers of the United States for iron and steel, and the phenomenal growth of the industry as a whole during the last thirty years, are most strikingly shown by comparing the production of 1900 with that of 1870. In the former year the production of iron and steel amounted to 29,507,860 gross tons, while in the latter year it amounted to only 3,263,585 tons, an increase during the thirty years

under review of 26,244,275 tons, or 804.2 per cent. The steady growth of the industry by decades is also forcibly shown by comparing the figures for each of the census periods.

In 1870 the total production of iron and steel amounted to 3,263,585 gross tons; in 1880 it had grown to 6,486,733 tons, an increase of 3,223,148 tons, or 98.8 per cent; in 1890 it had jumped to 16,264,478 tons, an increase of 9,777,745 tons, or 150.7 per cent; and in 1900 it had reached the unprecedented total of 29,507,860 tons, an increase of 13,243,382 tons, or 81.4 per cent. In other words, notwithstanding the fact that the production of 1890 was of very large proportions, representing as it did an increase over 1880 of one and one-half times the output of that year, the increase in the production of 1900 over 1890 was over three-fourths of the total production of the year last named. This is indeed a remarkable showing for the closing year of the nineteenth century.

But coexistent with the phenomenal growth of the iron and steel industry from 1870 to 1900, there was a still more wonderful decrease in the cost to consumers of all iron and steel products. The installation at modern plants of the latest labor-saving machinery, the employment of highly skilled managers and workmen, and the ever increasing demand for iron and steel products have all tended to lower the price of finished materials to consumers. Thirty years ago the average price per ton of the 3,263,585 tons of products was $63.49; ten years later, in 1880, when the production amounted to 6,486,733 tons, the average price was $45.70 per ton; in 1890, ten years ago, when the production had grown to 16,264,478 tons, it was $29.43 per ton; and in 1900, a year of high prices and of great prosperity, when the production reached the enormous total of 29,507,860 tons, the average price per ton had fallen to $27.25, considerably less than one-half the price prevailing thirty years ago, and less than two-thirds of the price realized twenty years ago.

Summarizing the results shown above for 1900, compared with 1870, there was a wonderful growth in production and a phenomenal decrease in the average price per ton of products.

### CONSOLIDATIONS.

In the decade from 1890 to 1900 a large number of consolidations of iron and steel establishments were effected. During the census year 1900 there were 14 companies which owned or operated 136 blast furnaces with an annual capacity of 11,550,000 gross tons of pig iron, or over 54 per cent of the capacity reported for the whole country; 7 companies which had 41 Bessemer steel converters with an annual capacity of 8,000,000 tons of steel ingots or castings, or over 69 per cent of the total capacity; 12 companies which had 142 open-hearth furnaces with an annual capacity of 3,370,000 tons of steel ingots or castings, or over 59 per cent of the total capacity; and 19 companies which had 158 rolling mills with an annual capacity of 16,418,000 tons of rolled and forged iron and steel products, or over 60 per cent of the total capacity.

### COMPARATIVE PRODUCTION BY STATES AND TERRITORIES.

Table 3 shows the production of all forms of iron and steel, by states and territories, for 1870, 1880, 1890, and 1900, and the rank of each producing state or territory for each of the periods named.

TABLE 3.—IRON AND STEEL: TONS OF PRODUCTS, BY STATES, WITH RANK, 1870 TO 1900.

| STATES. | RANK. | | | | TONS OF PRODUCTS.[1] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880 | 1870 | 1900 | 1890 | 1880 | 1870 |
| United States | | | | | 29,507,860 | 16,264,478 | 6,486,733 | 3,263,585 |
| Pennsylvania | 1 | 1 | 1 | 1 | 15,290,711 | 8,622,745 | 3,229,168 | 1,640,007 |
| Ohio | 2 | 2 | 2 | 2 | 5,297,191 | 2,210,296 | 830,483 | 401,579 |
| Illinois | 3 | 3 | 4 | 15 | 2,954,876 | 1,479,754 | 373,185 | 23,001 |
| Alabama | 4 | 4 | 15 | 20 | 1,303,595 | 864,120 | 56,237 | 6,304 |
| West Virginia | 5 | 6 | 7 | 10 | 541,106 | 347,506 | 131,685 | 64,587 |
| New York | 6 | 5 | 3 | 3 | 475,635 | 530,100 | 534,196 | 400,229 |
| Virginia | 7 | 7 | 16 | 13 | 469,060 | 325,722 | 49,752 | 33,782 |
| Maryland | 8 | 15 | 12 | 5 | 468,558 | 109,088 | 99,048 | 85,200 |
| Indiana | 9 | 14 | 13 | 11 | 425,946 | 113,090 | 85,819 | 57,275 |
| Wisconsin | 10 | 10 | 6 | 12 | 404,827 | 258,784 | 159,763 | 37,709 |
| Tennessee | 11 | 8 | 14 | 14 | 387,649 | 282,625 | 68,339 | 30,629 |
| New Jersey | 12 | 9 | 5 | 4 | 292,154 | 270,920 | 217,732 | 102,912 |
| Kentucky | 13 | 16 | 11 | 7 | 255,875 | 83,357 | 110,492 | 77,439 |
| Colorado | 14 | 20 | 27 | ..... | 232,815 | 30,207 | 4,018 | (2) |
| Michigan | 15 | 11 | 8 | 8 | 221,860 | 239,656 | 127,426 | 77,392 |
| Massachusetts | 16 | 12 | 9 | 9 | 140,532 | 141,965 | 126,179 | 76,916 |
| Missouri | 17 | 13 | 10 | 6 | 100,001 | 114,945 | 112,284 | 84,723 |
| Connecticut | 18 | 19 | 17 | 16 | 54,365 | 44,627 | 33,983 | 22,594 |
| Delaware | 19 | 17 | 19 | 19 | 53,025 | 52,176 | 30,284 | 7,417 |
| Minnesota | 20 | 30 | ..... | ..... | 42,528 | 2,290 | (2) | (2) |
| California | 21 | 18 | 21 | 22 | 25,419 | 50,667 | 12,500 | 2,679 |
| Georgia | 22 | 21 | 18 | 18 | 21,505 | 27,633 | 31,386 | 8,602 |
| North Carolina | 23 | 29 | 31 | 23 | 11,543 | 3,015 | 392 | 1,608 |
| Texas | 24 | 25 | 30 | ..... | 9,789 | 7,991 | 1,250 | (2) |
| Wyoming | 25 | 24 | 23 | ..... | 9,422 | 8,308 | 8,741 | (2) |
| Rhode Island | 26 | 23 | 24 | 21 | 5,618 | 11,613 | 7,263 | 3,942 |
| Washington | 27 | 28 | ..... | ..... | 5,000 | 4,274 | (2) | (2) |
| Oregon | 28 | 26 | 28 | ..... | 4,505 | 7,510 | 2,857 | (2) |
| Maine | 29 | 22 | 22 | 17 | 2,750 | 12,500 | 9,702 | 15,302 |
| New Hampshire | ..... | 27 | 25 | ..... | (2) | 5,938 | 7,123 | (2) |
| Iowa | ..... | 31 | ..... | ..... | (2) | 1,056 | (2) | (2) |
| Kansas | ..... | ..... | 20 | ..... | (2) | (2) | 17,013 | (2) |
| Vermont | ..... | ..... | 26 | 24 | (2) | (2) | 5,911 | 1,362 |
| Nebraska | ..... | ..... | 29 | ..... | (2) | (2) | 1,786 | (2) |
| District of Columbia | ..... | ..... | 32 | ..... | (2) | (2) | 236 | (2) |
| South Carolina | ..... | ..... | ..... | 25 | (2) | (2) | (2) | 395 |

[1] Gross ton of 2,240 pounds.

[2] None reported.

During the census year 1900 there were 29 states which produced iron or steel in the form of pig iron, steel ingots or castings, rolled iron or steel, or hammered blooms and bars for sale, compared with 31 states and territories in 1890 which manufactured similar products, 32 in 1880, and 25 in 1870.

For over a hundred years Pennsylvania has led in the manufacture of iron and steel in the United States, and in 1900 it still held this position, being far in the lead of any other state in that year, its production amounting to 15,290,711 gross tons, as compared with 8,622,745 tons in 1890, 3,229,168 tons in 1880, and 1,640,007 tons in 1870. Of the total production of the whole country Pennsylvania contributed 51.8 per cent in 1900, against 53 per cent in 1890, 49.8 per cent in 1880, and 50.3 per cent in 1870. This state has produced practically one-half of the total quantity of iron and steel reported by the whole country for each of the four census periods named above. From 1890 to 1900 its increased production amunted to 6,667,966 gross tons, or 77.3 per cent, compared with an increase in the whole country during the same period of 13,243,382 tons, or 81.4 per cent. From 1880 to 1890 its output increased 5,393,577 tons, or 167 per cent, while the increased production of the whole country was 9,777,745 tons, or 150.7 per cent. From 1870 to 1880 its production increased 1,589,161 tons, or 96.9 per cent, and the output of the country at large increased 3,223,148 tons, or 98.8 per cent.

Ohio ranked second in production in 1900, 1890, 1880, and 1870, its output in the first period named amounting to 5,297,191 tons, against 2,210,296 tons in the second, 830,483 tons in the third, and 401,579 tons in the fourth period. Ohio's increased production in 1900 over 1890 amounted to 3,086,895 tons, or 139.7 per cent, compared with an increase of 1,379,813 tons in 1890 over 1880, or 166.1 per cent, and of 428,904 tons in 1880 over 1870, or 106.8 per cent. Of the total production for the whole country for 1900, Ohio contributed 18 per cent, compared with 13.6 per cent in 1890, 12.8 per cent in 1880, and 12.3 per cent in 1870.

Illinois ranked third in production in 1900 and 1890, fourth in 1880, and fifteenth in 1870, its total output in 1900 amounting to 2,954,876 tons, against 1,479,754 tons in 1890, 373,185 tons in 1880, and 23,001 tons in 1870. In 1900 it increased its production over 1890 by 1,475,122 tons, or 99.7 per cent, compared with an increase of 1,106,569 tons in 1890 over 1880, or 296.5 per cent, and of 350,184 tons, or 1,522.5 per cent, in 1880 over 1870. Of the total production for the whole country, Illinois contributed 10 per cent in 1900, against 9.1 per cent in 1890, 5.8 per cent in 1880, and seven-tenths of 1 per cent in 1870.

Alabama was fourth in rank in 1900 and 1890, fifteenth in 1880, and twentieth in 1870, its total production in 1900 amounting to 1,303,595 tons, against 864,120 tons in 1890, 56,237 tons in 1880, and 6,304 tons in 1870. In 1900 it increased its production over 1890 by 439,475 tons, or 50.9 per cent, as compared with an increase in 1890 over 1880 of 807,883 tons, or 1,436.6 per cent, and in 1880 over 1870 of 49,933 tons, or 792.1 per cent. Alabama contributed to the total production of the country 4.4 per cent in 1900, 5.3 per cent in 1890, 0.9 per cent in 1880, and 0.2 per cent in 1870.

The four states named above—Pennsylvania, Ohio, Illinois, and Alabama—produced, as a whole, during the census year 1900, 24,846,373 tons of iron and steel, compared with 13,176,915 tons in 1890, 4,489,073 tons in 1880, and 2,070,891 tons in 1870. In 1900 their proportion of the total production of the country was 84.2 per cent, in 1890 it was 81 per cent, in 1880 it was 69.2 per cent, and in 1870 it was 63.5 per cent. They increased their aggregate production in 1900 over 1890 by 11,669,458 tons, or 88.6 per cent; in 1890 over 1880 by 8,687,842 tons, or 193.5 per cent; and in 1880 over 1870 by 2,418,182 tons, or 116.8 per cent.

West Virginia was fifth in rank in 1900, having advanced from the tenth position in 1870 to the seventh position in 1880, and to the sixth position in 1890, its production amounting to 541,106 tons in 1900, against 347,506 tons in 1890, 131,685 tons in 1880, and 64,587 tons in 1870. New York, which occupied the fifth rank in 1890, fell to the sixth in 1900. It was third in both 1880 and 1870. Its production in 1900 was 475,635 tons, against 530,100 tons in 1890, 534,196 tons in 1880, and 400,229 tons in 1870. It will probably hereafter assume a more important rank in the list of iron and steel producing states, as a large and modern plant for the manufacture of pig iron, Bessemer steel, open-hearth steel, Bessemer steel rails, and other leading rolled products is now being erected near Buffalo. Virginia was seventh in both 1900 and 1890, having advanced to this position from the sixteenth place in 1880. In 1870 it occupied the thirteenth position. Maryland was eighth in rank in 1900, having jumped to this place from the fifteenth position in 1890. In 1880 its rank was twelfth and in 1870 it was fifth. Indiana held the ninth place in 1900, the fourteenth in 1890, the thirteenth in 1880, and the eleventh in 1870. Wisconsin was tenth in rank in both 1900 and 1890, sixth in 1880, and twelfth in 1870. Tennessee, which held the eighth rank in 1890, fell to the eleventh place in 1900. In both 1880 and 1870 it held the fourteenth place. New Jersey fell from the ninth position in 1890 to the twelfth in 1900. In 1880 it was fifth in rank and in 1870 it was fourth. Kentucky advanced from the sixteenth position in 1890 to the thirteenth in 1900, but in 1880 it occupied the eleventh position and in 1870 the seventh. Colorado was fourteenth in rank in 1900, having advanced to that place from the twentieth position in 1890, and the twenty-seventh in 1880. In 1870 it was not enumerated among the producers of iron or steel. Michigan, which ranked eighth in both 1870 and 1880, and which in 1890 had fallen to the eleventh place, reached a still lower rank in 1900, its position in that year being fifteenth. Massachusetts, which was the

first of the original colonies to manufacture iron, and which occupied the ninth rank in 1870 and 1880, declined to the twelfth position in 1890, and to the sixteenth in 1900. Missouri was seventeenth in rank in 1900, having fallen from the sixth place in 1870 to the tenth in 1880 and to the thirteenth in 1890. Connecticut held almost the same rank in 1900 as in 1870, its position in the year last named having been sixteenth, seventeenth in 1880, nineteenth in 1890, and eighteenth in 1900, a slight recovery in the latter year, as compared with ten years ago. During the thirty years above enumerated, however, the production of iron and steel in this state advanced from 22,594 tons in 1870 to 54,365 tons in 1900, showing that, while the rank of the state has slightly declined in the period named, there has been a fair growth in production. Delaware occupied exactly the same rank in 1900 as it did in 1870 and 1880, namely, nineteenth. In 1890 it had advanced to the seventeenth position, only to fall back in 1900 to its former place. Minnesota did not produce iron or steel in 1870 or 1880. In 1890 it was thirtieth in rank, and in 1900 it had advanced to the twentieth place. California occupied the twenty-first rank in 1900, the eighteenth in 1890, the twenty-first in 1880, and the twenty-second in 1870. Its production of iron and steel has gradually declined during recent years. Georgia fell from the eighteenth rank in 1870 to the twenty-second in 1900. In 1890 it held the twenty-first rank, and in 1880 the eighteenth, the same as in 1870. North Carolina ranked twenty-third in 1900, twenty-ninth in 1890, thirty-first in 1880, and twenty-third in 1870. Wyoming occupied the twenty-fifth rank in 1900, the twenty-fourth in 1890, and the twenty-third in 1880. It was not a producer in 1870. Rhode Island ranked twenty-sixth in production in 1900, twenty-third in 1890, twenty-fourth in 1880, and twenty-first in 1870. Its iron and steel industries have shown a gratifying growth since the close of the census year 1900. Maine ranked seventeenth as a producer in 1870, twenty-second in 1880 and 1890, and twenty-ninth in 1900. Its production in 1870 amounted to 15,302 tons, but in 1900 it made only 2,750 tons.

With the exception of California, Georgia, Maine, Massachusetts, Michigan, Missouri, New York, Oregon, and Rhode Island, all the states producing iron and steel in 1900 increased their output over 1890. The falling off in Massachusetts was very slight, the decrease amounting to only 1,433 tons. In Missouri the loss amounted to 14,944 tons. New York's loss was 58,561 tons, compared with its production of twenty years ago, and 54,465 tons compared with its output ten years ago; but, as heretofore stated, its productive capacity in the immediate future will probably be considerably augmented. Georgia has suffered a steady decline in production since 1880, its output in that year amounting to 9,881 tons more than in 1900. California's production in 1900 was a little over one-half of its output in 1890, and its productive capacity has still further declined since the close of the census year, one or two plants which were active in that year having been recently abandoned. Maine had two establishments in operation in 1890, but one only in 1900. Its decreased production amounted to 9,750 tons. Rhode Island had but a single establishment in operation in both 1900 and 1890. Its production in the former year was about one-half of its output in the latter year.

The states which show an increase of over 1,000,000 tons in production in 1900 over 1890 are Pennsylvania, Ohio, and Illinois. Those showing an increase of over 300,000 tons are Alabama, Indiana, and Maryland; and those showing an increase of over 100,000 tons are Colorado, Kentucky, Tennessee, Virginia, West Virginia, and Wisconsin. None of the remaining producing states show an increase of over 50,000 tons.

### CAPITAL.

Table 4 is a comparative summary of the capital invested in active, idle, and building establishments (including rented property) as returned at the censuses 1880 to 1900, inclusive. Idle establishments embrace all plants which were not in operation during the census years enumerated, but which were in good condition and could readily be put into operation. Establishments which at one time were engaged in the manufacture of iron and steel, but which were not likely to resume operations, are not included in this table.

TABLE 4.—IRON AND STEEL: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 797 | [1] $615,165,273 | $305,284,033 | $309,881,240 |
| | 1890 | 872 | [1] 430,505,580 | 212,595,672 | 217,909,908 |
| | 1880 | 1,005 | [2] 230,971,884 | 122,004,227 | 108,967,657 |
| Active | 1900 | 669 | 590,530,484 | 287,669,533 | 302,860,951 |
| | 1890 | 719 | 414,044,844 | 200,197,208 | 213,847,636 |
| | 1880 | 792 | 209,904,965 | 112,320,428 | 97,584,537 |
| Idle | 1900 | 94 | 18,368,032 | 12,696,122 | 5,671,910 |
| | 1890 | 119 | 12,369,058 | 9,185,667 | 3,183,391 |
| | 1880 | 200 | 18,939,988 | 9,094,349 | 9,845,639 |
| In course of construction | 1900 | 34 | 6,266,757 | 4,918,378 | 1,348,379 |
| | 1890 | 34 | 4,091,678 | 3,212,797 | 878,881 |
| | 1880 | 13 | 2,126,931 | 589,450 | 1,537,481 |

[1] Includes rented property valued in 1900 at $17,245,416; in 1890, at $8,291,058.
[2] See remarks concerning the inclusion of capital invested in mining and other operations in the figures given for 1880 (page 4).

The above statement shows most graphically the phenomenal growth of the iron and steel industry during the last twenty years. While the number of active,

idle, and building establishments has decreased from 1,005 in 1880 to 797 in 1900, the capital invested in the establishments enumerated increased from $230,971,884 in 1880 (which, as heretofore explained, included capital invested by iron and steel manufacturing enterprises in iron-ore mines, coal mines, charcoal pits, etc.) to $615,165,273 in 1900 (which, as in 1890, included capital invested in the manufacture of iron and steel only), an increase of $384,193,389, or 166.3 per cent. Of the total capital reported for 1900, $590,530,484 was invested in active establishments, $18,368,032 in idle establishments, and $6,266,757 in building establishments. In 1890 the capital invested aggregated $430,505,580, divided as follows: Active establishments, $414,044,844; idle establishments, $12,369,058; and building plants, $4,091,678. For 1880 the figures are: Total capital, $230,971,884, of which $209,904,965 was invested in active establishments, $18,939,988 in idle establishments, and $2,126,931 in plants under construction. Practically one-half of the aggregate capital reported for each of the three census periods given in the table was invested in buildings, machinery, tools, and implements, and one-half in land, cash, etc.

Included in the aggregate capital invested in 1900 is rented property to the value of $17,245,416; and for 1890 similar property to the value of $8,291,058. In 1880 the value of rented property was not separately reported.

The steady decline in the number of active establishments during the past twenty years, as shown in Table 4, will not escape notice. In 1880 there were in operation during the census year 792 establishments, but in 1890 the number had fallen to 719, a loss of 73, and in 1900 it had still further decreased to 669, a loss in the ten years of 50. The total decline during the twenty years was 123. In 1880 the number of idle establishments was 200; in 1890 it was 119; and in 1900 it was 94, or 106 less than twenty years ago. The number of building plants at the close of the census year 1880 was 13, while in 1890 there were 34 in course of construction. At the close of 1900 the number of plants under construction was also 34.

Table 5 shows the capital invested in active, idle, and building blast furnaces, rolling mills and steel works, and forge and bloomery establishments for 1900, 1890, and 1880.

TABLE 5.—IRON AND STEEL: DISTRIBUTION OF CAPITAL IN DIFFERENT BRANCHES, 1880 TO 1900.

| CLASSES. | Year. | BLAST FURNACES. | | ROLLING MILLS AND STEEL WORKS. | | FORGES AND BLOOMERIES. | |
|---|---|---|---|---|---|---|---|
| | | Number of establishments. | Capital. | Number of establishments. | Capital. | Number of establishments. | Capital. |
| Total | 1900 | 278 | [1] $159,379,033 | 505 | [1] $455,166,752 | 14 | [1] $619,488 |
| | 1890 | 400 | [1] 143,693,926 | 440 | [1] 285,795,684 | 32 | 1,074,970 |
| | [2] 1880 | 490 | 105,151,176 | 397 | 121,424,745 | 118 | 4,395,963 |
| Active | 1900 | 224 | 148,226,113 | 438 | 441,795,983 | 7 | 508,388 |
| | 1890 | 304 | 134,608,543 | 395 | 278,559,831 | 20 | 876,470 |
| | 1880 | 341 | 89,531,362 | 358 | 116,458,390 | 93 | 3,915,213 |
| Idle | 1900 | 49 | 10,126,445 | 38 | 8,130,487 | 7 | 111,100 |
| | 1890 | 73 | 6,458,865 | 34 | 5,711,693 | 12 | 193,500 |
| | 1880 | 142 | 14,394,883 | 33 | 4,064,355 | 25 | 480,750 |
| In course of construction | 1900 | 5 | 1,026,475 | 29 | 5,240,282 | ..... | ..... |
| | 1890 | 23 | 2,566,518 | 11 | 1,525,160 | ..... | ..... |
| | 1880 | 7 | 1,224,931 | 6 | 902,000 | ..... | ..... |

[1] Includes the value of rented property, as follows: Blast furnaces—1900, $5,092,581; 1890, $5,061,058. Rolling mills and steel works—1900, $11,916,835; 1890, $3,280,000. Forges and bloomeries—1900, $236,000.
[2] See remarks concerning the inclusion of capital invested in mining and other operations in the figures given for 1880 (page 4).

As has been heretofore shown, the aggregate capital invested in the iron and steel industry at the close of the census year 1900 was $615,165,273, compared with $430,505,580 in 1890 and $230,971,884 in 1880. In Table 5 the part of this capital invested in each of the three branches of iron and steel manufacture under review is given in detail. In comparing capital for 1900 and 1890 with that for 1880, the remarks concerning the inclusion of capital invested by iron and steel establishments in mining and other operations, in the year last named, must not be overlooked.

In 1900 over one-fourth of the aggregate capital reported was invested in the blast furnace industry, and a little less than three-fourths in the rolling mill and steel works industry. The amount invested in the forge and bloomery industry in 1900 was only one-tenth of 1 per cent of the total capital reported. In 1890 the blast furnace industry reported about one-third of the aggregate capital invested, the rolling mill and steel works industry a little less than two-thirds, and the forge and bloomery industry a little over two-tenths of 1 per cent. In 1880 the capital invested in the blast furnace industry was a little over nine-twentieths, in the rolling mill and steel works industry a little over

one-half, and in the forge and bloomery industry a little less than 2 per cent of the aggregate capital reported.

In active blast-furnace establishments in 1900, the capital invested amounted to $148,226,113, against $134,608,543 similarly invested in 1890 and $89,531,362 in 1880. In idle blast-furnace establishments the capital invested in 1900 was $10,126,445, compared with $6,458,865 similarly invested in 1890 and $14,394,883 in 1880. During each of the three census periods given in the table the amount of capital invested in building blast-furnace enterprises exceeded $1,000,000, the figures being as follows: 1900, $1,026,475; 1890, $2,566,518; 1880, $1,224,931.

Referring to rolling mills and steel works, it is found that the aggregate capital invested in active establishments amounted in 1900 to $441,795,983, compared with $278,559,831 in 1890 and $116,458,390 in 1880, the amount reported in 1900 being almost four times the amount reported in 1880. The idle rolling-mill establishments in 1900 represented an investment of $8,130,487, compared with $5,711,693 in 1890 and $4,064,355 in 1880. In establishments in course of construction the investment in 1900 amounted to $5,240,282, against $1,525,160 in 1890 and $902,000 in 1880.

As indicated by the figures given in Table 5, the forge and bloomery industry is rapidly declining. From an aggregate investment of $4,395,963 in establishments of this character in 1880, the amount has fallen to $619,488 in 1900. In 1890 the amount invested was $1,074,970. Of the total for 1900, the active establishments reported an investment of $508,388, compared with $876,470 in 1890 and $3,915,213 in 1880. In 1900 the idle establishments reported capital to the amount of $111,100, against $198,500 in 1890 and $480,750 in 1880. Not one forge or bloomery for the production of bars or blooms for sale was in process of construction in the United States at the close of the census year 1900, nor was any plant of this character erected in this country during the year named.

As shown in Table 4, the number of active, idle, and building iron and steel establishments in the United States in 1900 was 797, against 872 in 1890 and 1,005 in 1880, a decrease in twenty years of 208. Table 5 shows in which of the three branches under review the decline has taken place.

Beginning with blast furnaces, it is found that the number of establishments has declined in twenty years from 490 in 1880 to 278 in 1900, a loss of 212. It is also found that during the same period the number of establishments which owned or operated forges or bloomeries declined from 118 to 14, a loss of 104. In the blast furnace and forge and bloomery industries the loss in establishments from 1880 to 1900 is thus shown to be 316.

Taking up the rolling mill and steel works industry, however, a very gratifying gain in establishments for the twenty years is shown, the number having advanced from 397 in 1880 to 440 in 1890 and to 505 in 1900, the gain during the twenty years being 108 establishments. It may be added that since the close of the census year a large number of new rolling mills and steel plants have been built, while the work of erecting additional plants is now being vigorously pushed. At the close of December, 1901, between 30 and 35 new plants were being equipped in the United States for the manufacture of pig iron, steel, or rolled iron and steel. But, on the other hand, not one forge or bloomery for the manufacture of bars or blooms for sale was being built in the whole country on the date named.

As shown in Table 4, the total number of all kinds of active iron and steel establishments was 669 in 1900, 719 in 1890, and 792 in 1880. Of the total for 1900, Table 5 shows that 224 were classed as blast furnaces, compared with 304 in 1890 and 341 in 1880; 438 were classed as rolling mills and steel works, compared with 395 in 1890 and 358 in 1880; and 7 were classed as forges and bloomeries, compared with 20 in 1890 and 93 in 1880. Of the 94 idle establishments reported for 1900, 49 were classed as blast furnaces, 38 as rolling mills and steel works, and 7 as forges and bloomeries, against a total of 119 idle establishments in 1890 (blast furnaces, 73; rolling mills and steel works, 34; and forges and bloomeries, 12) and 200 in 1880 (blast furnaces, 142; rolling mills and steel works, 33; and forges and bloomeries, 25). The establishments in course of construction were divided as follows in 1900: Blast furnaces, 5, and rolling mills and steel works, 29; in 1890, blast furnaces, 23, and rolling mills and steel works, 11; and in 1880, blast furnaces, 7, and rolling mills and steel works, 6. The number of blast furnaces which were being added to existing establishments is not, however, included in the above statement for any of the census years. No forges or bloomeries were being erected at any of the three periods covered by the table.

Table 6 is a comparative summary, by states, of the capital invested in active, idle, and building establishments in 1880, 1890, and 1900.

TABLE 6.—IRON AND STEEL: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, BY STATES, 1880 TO 1900.

| STATES. | Year. | TOTAL. | | ACTIVE. | | IDLE. | | IN COURSE OF CONSTRUCTION. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number of establishments. | Capital. | Number of establishments. | Capital. | Number of establishments. | Capital. | Number of establishments. | Capital. |
| United States | 1900 | 797 | [1]$615,165,273 | 669 | $590,530,484 | 94 | $18,368,032 | 34 | $6,266,757 |
| | 1890 | 872 | [1]430,505,580 | 719 | 414,044,844 | 119 | 12,369,058 | 34 | 4,091,678 |
| | 1880 | 1,005 | 230,971,884 | 792 | 209,904,965 | 200 | 18,939,988 | 13 | 2,126,931 |
| Alabama | 1900 | 37 | 19,058,368 | 25 | 16,091,479 | 10 | 2,200,989 | 2 | 765,900 |
| | 1890 | 45 | 19,070,976 | 35 | 17,987,583 | 3 | 297,393 | 7 | 786,000 |
| | 1880 | 14 | 3,309,196 | 8 | 2,757,196 | 5 | 399,000 | 1 | 153,000 |
| California | 1900 | 4 | 1,514,162 | 3 | 1,499,162 | 1 | 15,000 | ..... | ..... |
| | 1890 | 4 | 4,656,611 | 4 | 4,656,611 | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 1,000,000 | 1 | 1,000,000 | ..... | ..... | ..... | ..... |
| Connecticut | 1900 | 11 | 5,125,258 | 8 | 4,986,147 | 3 | 139,111 | ..... | ..... |
| | 1890 | 15 | 2,317,821 | 13 | 2,189,521 | 2 | 128,300 | ..... | ..... |
| | 1880 | 19 | 2,682,000 | 17 | 2,557,000 | 2 | 125,000 | ..... | ..... |
| Delaware | 1900 | 6 | 4,207,079 | 6 | 4,207,079 | ..... | ..... | ..... | ..... |
| | 1890 | 9 | 2,960,722 | 7 | 2,558,865 | 2 | 401,857 | ..... | ..... |
| | 1880 | 9 | 1,431,469 | 8 | 1,341,469 | 1 | 90,000 | ..... | ..... |
| Georgia | 1900 | 6 | 1,271,216 | 3 | 666,916 | 2 | 551,300 | 1 | 53,000 |
| | 1890 | 7 | 991,243 | 5 | 908,243 | 1 | 43,000 | 1 | 40,000 |
| | 1880 | 14 | 1,135,900 | 9 | 973,800 | 5 | 162,100 | ..... | ..... |
| Illinois | 1900 | 30 | 43,754,299 | 26 | 43,356,239 | 1 | 14,000 | 3 | 384,060 |
| | 1890 | 30 | 35,473,169 | 24 | 34,689,919 | 4 | 513,250 | 2 | 270,000 |
| | 1880 | 21 | 6,460,620 | 16 | 5,795,620 | 4 | 490,000 | 1 | 175,000 |
| Indiana | 1900 | 31 | 16,369,210 | 27 | 14,994,210 | 2 | 600,000 | 2 | 775,000 |
| | 1890 | 18 | 4,387,095 | 15 | 4,099,095 | 3 | 288,000 | ..... | ..... |
| | 1880 | 12 | 2,283,000 | 12 | 2,283,000 | ..... | ..... | ..... | ..... |
| Kentucky | 1900 | 11 | 4,443,987 | 8 | 4,198,987 | 2 | 210,000 | 1 | 35,000 |
| | 1890 | 15 | 3,044,655 | 9 | 2,310,655 | 4 | 380,000 | 2 | 354,000 |
| | 1880 | 29 | 5,493,035 | 18 | 4,610,035 | 11 | 883,000 | ..... | ..... |
| Maryland | 1900 | 12 | 4,012,937 | 9 | 3,765,003 | 3 | 247,934 | ..... | ..... |
| | 1890 | 14 | 5,170,574 | 10 | 4,217,574 | 3 | 385,000 | 1 | 568,000 |
| | 1880 | 23 | 4,962,125 | 18 | 4,402,125 | 5 | 560,000 | ..... | ..... |
| Massachusetts | 1900 | 9 | 14,248,593 | 8 | 13,738,593 | ..... | ..... | 1 | 510,000 |
| | 1890 | 16 | 9,068,555 | 15 | 9,005,555 | 1 | 63,000 | ..... | ..... |
| | 1880 | 30 | 6,738,408 | 24 | 6,163,408 | 6 | 575,000 | ..... | ..... |
| Michigan | 1900 | 16 | 4,623,031 | 10 | 3,934,050 | 6 | 688,981 | ..... | ..... |
| | 1890 | 29 | 7,225,241 | 19 | 6,696,541 | 6 | 373,700 | 4 | 155,000 |
| | 1880 | 22 | 4,175,386 | 15 | 3,342,386 | 6 | 813,000 | 1 | 20,000 |
| Minnesota | 1900 | 5 | 2,163,582 | 3 | 713,806 | 2 | 1,449,776 | ..... | ..... |
| | [2]1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 150,000 | ..... | ..... | 1 | 150,000 | ..... | ..... |
| Missouri | 1900 | 9 | 2,792,781 | 7 | 2,611,278 | ..... | ..... | 2 | 181,503 |
| | 1890 | 13 | 5,890,428 | 9 | 3,495,913 | 4 | 2,394,515 | ..... | ..... |
| | 1880 | 22 | 9,152,472 | 12 | 5,698,600 | 8 | 3,104,500 | 2 | 349,372 |
| New Jersey | 1900 | 30 | 21,011,152 | 25 | 20,336,609 | 5 | 674,543 | ..... | ..... |
| | 1890 | 37 | 12,649,162 | 28 | 11,697,362 | 9 | 951,800 | ..... | ..... |
| | 1880 | 40 | 9,099,050 | 37 | 8,764,050 | 3 | 335,000 | ..... | ..... |
| New York | 1900 | 39 | 16,373,578 | 30 | 13,292,346 | 7 | 2,716,532 | 2 | 364,700 |
| | 1890 | 55 | 17,330,190 | 44 | 16,282,435 | 11 | 1,047,755 | ..... | ..... |
| | 1880 | 89 | 21,543,221 | 74 | 19,752,471 | 15 | 1,790,750 | ..... | ..... |
| Ohio | 1900 | 116 | 88,570,252 | 107 | 86,477,552 | 2 | 80,000 | 7 | 2,012,700 |
| | 1890 | 118 | 39,927,200 | 101 | 37,642,887 | 16 | 2,197,013 | 1 | 87,300 |
| | 1880 | 134 | 25,141,294 | 103 | 22,807,606 | 30 | 2,244,688 | 1 | 89,000 |
| Pennsylvania | 1900 | 331 | 326,603,098 | 291 | 321,985,659 | 29 | 4,067,545 | 11 | 549,894 |
| | 1890 | 344 | 228,194,361 | 311 | 226,294,407 | 30 | 1,332,175 | 3 | 567,779 |
| | 1880 | 366 | 107,304,782 | 321 | 102,956,223 | 41 | 3,608,000 | 4 | 740,559 |
| Tennessee | 1900 | 20 | 6,268,315 | 16 | 5,432,665 | 3 | 450,650 | 1 | 385,000 |
| | 1890 | 20 | 5,051,154 | 15 | 4,613,355 | 3 | 256,500 | 2 | 181,299 |
| | 1880 | 43 | 3,681,776 | 29 | 2,862,826 | 14 | 818,950 | ..... | ..... |
| Texas | 1900 | 4 | 653,215 | 3 | 379,215 | 1 | 274,000 | ..... | ..... |
| | [2]1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 40,000 | 1 | 40,000 | ..... | ..... | ..... | ..... |
| Virginia | 1900 | 29 | 8,236,858 | 20 | 6,941,696 | 9 | 1,295,162 | ..... | ..... |
| | 1890 | 39 | 7,508,093 | 21 | 6,330,993 | 9 | 253,800 | 9 | 923,300 |
| | 1880 | 44 | 4,329,713 | 21 | 2,294,713 | 22 | 1,535,000 | 1 | 500,000 |
| West Virginia | 1900 | 13 | 8,583,445 | 11 | 8,202,910 | 1 | 130,535 | 1 | 250,000 |
| | 1890 | 13 | 6,488,924 | 12 | 6,458,924 | 1 | 30,000 | ..... | ..... |
| | 1880 | 20 | 3,913,616 | 16 | 3,712,616 | 3 | 161,000 | 1 | 40,000 |
| Wisconsin | 1900 | 13 | 7,238,654 | 12 | 5,918,329 | 1 | 1,320,325 | ..... | ..... |
| | 1890 | 11 | 6,582,031 | 9 | 6,461,531 | 1 | 6,500 | 1 | 114,000 |
| | 1880 | 9 | 2,843,218 | 8 | 2,768,218 | 1 | 75,000 | ..... | ..... |
| All other states[3] | 1900 | 15 | 8,042,203 | 11 | 6,800,554 | 4 | 1,241,649 | ..... | ..... |
| | 1890 | 20 | 6,517,375 | 13 | 5,446,875 | 6 | 1,025,500 | 1 | 45,000 |
| | 1880 | 42 | 4,101,603 | 24 | 3,021,603 | 17 | 1,020,000 | 1 | 60,000 |

[1] Includes rented property valued in 1900 at $17,245,416; in 1890 at $8,291,058.
[2] Included in "all other states."
[3] Includes establishments distributed as follows: 1900—Colorado, 3; Kansas, 1; Maine, 2; North Carolina, 3; Oregon, 2; Rhode Island, 1; Washington, 2; Wyoming, 1. 1890—Colorado, 3; Iowa, 1; Kansas, 1; Maine, 2; Minnesota, 2; New Hampshire, 1; North Carolina, 1; Oregon, 1; Rhode Island, 1; Texas, 5; Washington, 1; Wyoming, 1. 1880—Colorado, 1; District of Columbia, 1; Kansas, 2; Maine, 3; Nebraska, 1; New Hampshire, 2; North Carolina, 20; Oregon, 1; Rhode Island, 3; Utah, 3; Vermont, 4; Wyoming, 1.

As has been previously explained, the capital reported above for the three branches of the iron and steel industry under review does not represent the total amount of capital actually invested by the iron and steel manufacturing establishments of the country. It must be borne in mind that the figures given in Table 6 for 1900 and 1890 cover only the capital invested in the operation of blast furnaces, rolling mills and steel works, and forges and bloomeries, the establishments last named being included only when they produce bars and blooms for sale. Many iron and steel establishments have large amounts of capital invested in iron ore mines, coal mines, limestone quarries, coke ovens, charcoal kilns, and other similar industries which furnish fuel and raw materials for blast furnaces, rolling mills, steel plants, bloomeries, etc. All capital of this character has been eliminated from the data for 1900 and 1890, although for 1880 it is included. The persons employed in these industries, and the wages paid them, have also been eliminated for the two former periods, but for the period last named they are included. If statistics for the industries named were included the capital invested for 1890 and 1900—and especially for 1900—would be increased by many millions of dollars, the amount paid in wages would be greatly augmented, and the number of employees would be swollen by tens of thousands.

A few details concerning the capital invested by the leading iron and steel producing states, as shown in Table 6, may be of interest.

Pennsylvania led all the other states in 1900, 1890, and 1880 in the number of establishments and in the amount of capital invested in the iron and steel industry. In 1900 it had a total of 331 active, idle, or building establishments, compared with 344 in 1890 and 366 in 1880, a decrease in the twenty years of 35. During the same period, however, it had increased the capital invested from $107,304,782 in 1880 to $326,603,098 in 1900, or $219,298,316. Much the larger part of this increase was in the rolling mill and steel works industry, which jumped from $60,489,929 invested in active establishments in 1880 to $247,001,768 similarly invested in 1900, an increase of $186,511,839. During the same period the capital invested in active blast furnace establishments advanced from $41,488,294 in 1880 to $74,850,426 in 1900, an increase of $33,362,132. The total number of establishments in operation in Pennsylvania during the census year 1900 was 291, as compared with 311 in 1890 and 321 in 1880. In 1900 the state had 11 plants in course of construction, against 3 in 1890 and 4 in 1880. Its idle establishments numbered 29 in 1900, 30 in 1890, and 41 in 1880.

Ohio, which ranks second in the number of establishments and in the capital invested, had 116 active, idle, or building establishments in 1900, as compared with 118 in 1890 and 134 in 1880, a decrease in the two decades of 18. From 1880 to 1900, however, the amount of capital invested had advanced from $25,141,294 in 1880 to $39,927,200 in 1890, and to $88,570,252 in 1900, the total increase in the twenty years being $63,428,958. As in Pennsylvania, much the larger part of this increase was in the rolling mill and steel works industry, which advanced from $9,805,020 invested in active establishments in 1880 to $63,181,422 in 1900, an increase of $53,376,402. The capital invested in active blast furnace establishments advanced from $13,002,586 to $23,296,130 during the same period, an increase of $10,293,544. During the census year 1900 Ohio had 107 establishments in operation, compared with 101 in 1890 and 103 in 1880, a total gain of 4. Its idle establishments in 1900 numbered 2, against 16 in 1890 and 30 in 1880. The number of establishments in course of construction in 1900 was 7, as compared with 1 in both 1890 and 1880. The amount of capital invested in the building establishments in Ohio in 1900 amounted to almost one-third of the total amount reported for building establishments for the whole country.

Illinois was third in rank in 1900 in the amount of capital invested, but in the number of establishments New York, Alabama, and Indiana ranked higher, the state first named having 39, the second 37, and the third 31 establishments. Illinois reported 30 establishments, the same number as New Jersey. In 1890 Illinois also had 30 establishments, and in 1880 it had 21 establishments. From 1880 to 1900 the capital invested in iron and steel establishments in Illinois increased from $6,460,620 in the former year to $43,754,299 in the latter year, a gain of $37,293,679. Of the total amount invested in 1880, $4,845,620 was reported by active rolling mills and steel works establishments; in 1900 the amount so reported was $32,672,326, a gain of $27,826,706. In 1880 the amount invested in active blast furnace establishments was only $950,000, but in 1900 it amounted to $10,683,913, an increase of $9,733,913. As in Pennsylvania and Ohio, the increase in capital was chiefly in the rolling mill and steel works industry. The number of establishments in operation in Illinois in 1900 was 26, as compared with 24 in 1890 and 16 in 1880. The state had 1 idle establishment in 1900 and 4 idle establishments in both 1890 and 1880. There were 3 plants under construction in 1900, 2 in 1890, and 1 in 1880.

Of the remaining states, with the single exception of New Jersey, which reported a capital of $21,011,152 in 1900, a gain of $8,361,990 compared with 1890, no other state had $20,000,000 invested in the manufacture of iron and steel in 1900. Three states reported less than $20,000,000 but more than $15,000,000 in 1900, namely, Alabama, $19,058,368 (a loss of $12,608 compared with 1890); New York, $16,373,578 (a loss of $956,612 compared with 1890); and Indiana, $16,369,210 (a gain of $11,982,115 compared with 1890). One state only, Massachusetts, reported capital between $10,000,000 and $15,000,000, the amount being

$14,248,593. Five states—Connecticut, Virginia, West Virginia, Tennessee, and Wisconsin—reported less than $10,000,000 but more than $5,000,000; and four states—Delaware, Maryland, Kentucky, and Michigan—reported less than $5,000,000 but more than $4,000,000. None of the remaining states reported over $3,000,000.

Taking up the number of iron and steel establishments in the different states during 1900, and omitting the details for Pennsylvania, Ohio, and Illinois, particulars for which have already been given, it is found that Alabama had 37 establishments in the year named, of which 25 were active and 10 idle. Two plants were in course of construction. In 1890 the state had 45 establishments, of which, however, only 38 were completed, 7 being at that time in course of erection; of the 38 completed establishments 3 were idle.

California had 4 establishments in 1900, 3 of which were active and 1 idle; in 1890 it had 4 establishments, all of which were active. Connecticut had 11 establishments in 1900, 8 of which were active and 3 idle; in 1890 the state reported 15 establishments, 13 active and 2 idle. Delaware reported 6 establishments in 1900, all active, and in 1890 it reported 9 establishments, 7 active and 2 idle. Georgia in 1900 had 6 establishments, 3 active, 2 idle, and 1 in course of construction; in 1890 it had 7 establishments, of which 5 were active, 1 was idle, and 1 was being erected. Indiana reported 31 establishments in 1900, 27 active, 2 idle, and 2 building, while in 1890 it had a total of 18 establishments, 15 of which were active and 3 idle. Kentucky had 11 establishments in 1900, 8 active, 2 idle, and 1 in course of construction; in 1890 it had 15 establishments, 9 active, 4 idle, and 2 building. Maryland in 1900 reported 12 establishments, 9 of which were active and 3 idle; in 1890 it had 14 establishments, 10 of which were active, 3 idle, and 1 building. Massachusetts had 9 establishments in 1900, 8 of which were active and 1 building; in 1890 it reported 16 establishments, 15 of which were active and 1 idle. Michigan reported 16 establishments in 1900, and of this number 10 were active and 6 were idle; in 1890 it had 29 establishments, 19 of which were active, 6 idle, and 4 building. Minnesota had 5 establishments in 1900, 3 of which were active and 2 idle; in 1890 it had 2 establishments, 1 active and 1 idle. Missouri had 9 establishments in 1900, 7 of which were active and 2 building; in 1890 it reported 13 establishments, 9 active and 4 idle. New Jersey had 30 establishments in 1900, 25 active and 5 idle; in 1890 it had 37 establishments, 28 active and 9 idle.

New York had 39 establishments in 1900, 30 active, 7 idle, and 2 building, while in 1890 it had 55 establishments, 44 active and 11 idle. Tennessee had 20 establishments in 1900, 16 active, 3 idle, and 1 building; in 1890 it also had 20 establishments, of which 15 were active, 3 idle, and 2 building. Texas had 4 establishments in 1900, 3 active and 1 idle; in 1890 it had 5 establishments, 1 active, 3 idle, and 1 building. Virginia had 29 establishments in 1900, 20 active and 9 idle; in 1890 it had 39 establishments, 21 active, 9 idle, and 9 building. West Virginia had 13 establishments in 1900, 11 active, 1 idle, and 1 building; in 1890 it also had 13 establishments, 12 active and 1 idle. Wisconsin had 13 establishments in 1900, 12 active and 1 idle; in 1890 it had 11 establishments, 9 active, 1 idle, 1 building. Colorado had 3 establishments in 1900, all active; in 1890 it also had 3 establishments, 2 active and 1 idle. Kansas had 1 establishment in 1900, and it was in operation; in 1890 it also had 1 establishment, but it was idle. Maine had 2 establishments in 1900, 1 active and 1 idle; in 1890 it also had 2 establishments, both of which were active. North Carolina had 3 establishments in 1900, 2 active and 1 idle; in 1890 it had 1 establishment only, and it was in operation. Oregon had 2 establishments in 1900, 1 active and 1 idle; in 1890 it had 1 establishment only, which was active. Rhode Island had 1 establishment in both 1900 and 1890, and it was active in both years. Washington had 2 establishments in 1900, 1 active and 1 idle; in 1890 it had 1 establishment only, and it was running. Wyoming had 1 establishment in 1900 and 1 in 1890, and it was active in both periods. Neither Iowa nor New Hampshire, each of which had 1 active establishment in 1890, produced iron or steel in 1900, the plants in both states having been abandoned.

### MISCELLANEOUS EXPENSES.

In the census report for iron and steel for 1890, attention was especially called to the fact that in collecting the statistics for 1880 no attempt had been made to ascertain the total cost of manufacturing the products reported for that year, only the amount expended for labor and materials being embraced in the schedules sent to iron and steel manufacturers. Miscellaneous expenses, covering the amount paid for taxes, rent of offices, interest, insurance, advertising, stamps, and other similar expenditures were, therefore, omitted entirely from the total cost reported twenty years ago. In the census of 1890, however, all miscellaneous expenses of the character named were generally reported for that year. The amount expended for commissions on sales, the cost of operating the sales department, and expenses of a similar character, on the other hand, were not collected, and are not included in the total miscellaneous expenses reported for 1890. In cases where iron and steel manufacturing establishments mined iron ore and coal, quarried limestone, manufactured coke, made charcoal, operated railroads, etc., it was frequently impossible in 1890 to separate the amount paid for taxes, interest on cash used in the business, and other sundry expenses for these branches of industry from the amount paid for similar expenses for the iron and steel industry.

It very frequently happened, therefore, that the miscellaneous expenses connected with the operation of

these affiliated industries were all charged against the iron and steel manufacturing part of the establishment. The total miscellaneous expenses reported for 1890 are, therefore, considerably in excess of the amount which should in equity be charged against the manufacture of iron and steel.

In the census for 1900, however, a special effort was made to obtain as nearly as possible the actual amount of miscellaneous expenses incurred in operating only the iron and steel departments of establishments of the character named above. Where actual expenditures could not be had, manufacturers were requested to furnish careful estimates, apportioning the amount expended according to the circumstances surrounding each special industrial branch of the establishment. The $32,274,100 of miscellaneous expenses reported for 1900 may, therefore, be accepted as representing as nearly correct results as it is possible to obtain. As in 1890, however, the amount expended for commissions on sales or for the operation of the sales department of any establishment has not been included in the miscellaneous or other expenses reported.

### NUMBER OF WAGE-EARNERS.

In 1880, as has been heretofore stated, the clerks, etc., employed by iron and steel manufacturing establishments were not separately reported, no distinction being made between clerical help and labor employed in the actual operation of the various works. Nor were the salaries and wages paid given separately. In the census of 1890, however, wage-earners and piece-workers were separated from clerks, etc., and wages and salaries were reported separately. Proprietors and firm members, with their salaries, were also reported, and were combined with clerks and other officials.

In 1900 the same general plan was followed as in 1890, with the important exception that the number of proprietors and firm members was not included, as in 1890, in the total number of salaried officials, nor was the amount drawn by them included in the total salaries paid.

Table 7 shows the average number of wage-earners employed in 1880, 1890, and 1900 in the operation of blast furnaces, rolling mills and steel works, and forges and bloomeries (the latter, as stated heretofore, covering only establishments which manufacture blooms or bars for sale and not for their own consumption), and the percentage of men, women, and children employed.

In comparing the number of wage-earners reported for 1900 and 1890 with those reported for 1880, it may be well to again emphasize the fact that the figures given for the year last named for wage-earners at blast furnaces include not only workmen engaged in the manufacture of pig iron but also in many cases those employed in mining iron ore and coal, manufacturing coke, burning charcoal, and other operations conducted by pig-iron manufacturing establishments. Exact comparisons, therefore, for 1880 can not be made with the wage-earners reported for 1900 and 1890, in which all labor employed in the production of materials to be used in the blast furnaces has been carefully excluded. This will explain in part the apparent decrease in the number of employees reported for blast furnaces in 1900 and 1890 as compared with 1880. The improved labor-saving devices used so largely in 1900 and immediately preceding years have, however, undoubtedly displaced thousands of workmen who would otherwise have been employed at blast furnaces in handling ore, coal, coke, pig iron, etc.

TABLE 7.—IRON AND STEEL: AVERAGE NUMBER OF WAGE-EARNERS AND PROPORTION OF MEN, WOMEN, AND CHILDREN, 1880 TO 1900.

| CLASSES. | Year. | AVERAGE NUMBER OF WAGE-EARNERS. | | | | PER CENT OF TOTAL. | | |
|---|---|---|---|---|---|---|---|---|
| | | Total. | Men, 16 years and over. | Women, 16 years and over. | Children, under 16 years. | Men. | Women. | Children. |
| Total | 1900 | 222,607 | 219,635 | 1,071 | 1,901 | 98.7 | 0.5 | 0.8 |
| | 1890 | 171,181 | 168,943 | 58 | 2,180 | 98.7 | [1] | 1.3 |
| | 1880 | [2]140,798 | 133,023 | 45 | 7,730 | 94.5 | [1] | 5.5 |
| Blast furnaces | 1900 | 39,358 | 39,261 | 6 | 91 | 99.8 | [1] | 0.2 |
| | 1890 | 33,415 | 33,341 | ..... | 74 | 99.8 | ..... | 0.2 |
| | 1880 | 41,695 | 40,503 | 9 | 1,183 | 97.2 | [1] | 2.8 |
| Rolling mills and steel works | 1900 | 183,023 | 180,148 | 1,065 | 1,810 | 98.4 | 0.6 | 1.0 |
| | 1890 | 137,295 | 135,134 | 58 | 2,103 | 98.5 | [1] | 1.5 |
| | 1880 | 96,164 | 89,645 | 33 | 6,486 | 93.2 | [1] | 6.8 |
| Forges and bloomeries | 1900 | 226 | 226 | ..... | ..... | 100.0 | ..... | ..... |
| | 1890 | 471 | 468 | ..... | 3 | 99.4 | ..... | 0.6 |
| | 1880 | 2,939 | 2,875 | 3 | 61 | 97.8 | 0.1 | 2.1 |

[1] Less than one-tenth of 1 per cent.
[2] Does not include 180 employees reported by an idle establishment in Minnesota and included in the totals published at the census of 1880. These employees were engaged in making repairs to plant.

The total average number of wage-earners employed in the three branches of the iron and steel industry named in Table 7 in the census year 1900 was 222,607, compared with 171,181 in 1890 and 140,798 in 1880, the latter figures, as heretofore explained, including an unknown number of wage-earners not directly employed in the manufacture of iron and steel. Of the total reported for 1900, 219,635 were men, 16 years of age and over, compared with 168,943 in 1890 and 133,023 in 1880. The number of women, 16 years of age and over reported in 1900 was 1,071, against 58 in 1890 and 45 in 1880. In 1900 the number of children, under 16 years of age employed was 1,901, compared with 2,180 in 1890 and 7,730 in 1880.

Of the total wage-earners reported for 1900 almost five-sixths were employed in rolling mills and steel works, the number at work at blast furnaces and forges and bloomeries combined amounting to only a little over one-sixth, the figures being as follows: Rolling mills and steel works, 183,023; blast furnaces, 39,358; forges and bloomeries, 226; total 222,607.

Comparing the wage-earners employed at blast furnaces in 1900 with those similarly employed in 1890, the following result is obtained: 1900, 39,358; 1890, 33,415; increase in 1900 over 1890, 5,943. For reasons heretofore given no comparisons are made with furnace employees for 1880. The total for 1900 includes 39,261 men, 16 years of age and over, 6 women, 16 years of age and over, and 91 children, under 16 years of age. In the total for 1890 there were included 33,341 men and 74 children, no women being reported.

The rolling mills and steel works in 1900 employed, all told, 183,023 wage-earners, compared with 137,295 in 1890 and 96,164 in 1880. This is an increase in 1900 over 1890 of 45,728 employees and over 1880 of 86,859 employees. The number of men, 16 years of age and over, employed in 1900 was 180,148, compared with 135,134 in 1890 and 89,645 in 1880. The number of women, 16 years of age and over, shows an increase in 1900 compared with 1890 and 1880, the figures for the three periods being as follows: 1900, 1,065; 1890, 58; and 1880, 33. On the other hand the number of children employed in 1900 shows a decrease compared with both 1890 and 1880, the number employed at each of the three censuses being as follows: 1900, 1,810; 1890, 2,103; 1880, 6,486.

The number of wage-earners employed in the manufacture of hammered blooms and bars for sale shows a very heavy decline from 1880 to 1890, and a considerable decline from 1890 to 1900. The industry is rapidly passing away. The wage-earners reported in the census year 1900, all male, numbered 226, compared with 471 in 1890 (468 men, 16 years of age and over, and 3 children, under 16 years of age) and 2,939 in 1880 (2,875 men, 3 women, and 61 children).



### MATERIALS USED.

The quantity and cost of the materials used by blast furnaces, rolling mills and steel works, and forges and bloomeries during the census years 1880, 1890, and 1900 will be found in the three tables which follow. The total cost of all materials used by the three industries named, including freight charges, amounted to $522,431,701 in 1900, compared with $327,272,845 in 1890, $191,271,150 in 1880, and $135,526,132 in 1870.

A word of explanation is necessary concerning the cost of materials reported for the census year 1900. In that year an effort was made to obtain the actual cost of the materials used f. o. b. cars at point of shipment, in order that the total amount paid for freight charges on fuel, ore, mill cinder, scrap, etc., by iron and steel manufacturers might be definitely ascertained.

It was not found practicable, however, to secure full and complete data, as some establishments reported the cost of materials f. o. b. works, which, of course, included the freight charges, while others reported the cost at the point of shipment, the freight charges being separately stated. Still other establishments reported the cost of part of the materials used f. o. b. cars at point of shipment and a part delivered at works. In the census for 1890, as well as in the census for 1880, the cost reported for materials used was the cost at works, all freight charges being included. These facts must not be overlooked when comparing the cost of materials reported for 1900 with the cost reported for 1890 and 1880. When freight charges for 1900 are not embraced in the cost reported for ore, fuel, limestone, pig iron, scrap iron, etc., the amount is shown in the detailed Tables 71, 72, and 73, under materials used, as a separate item.

### CONSUMPTION OF FUEL.

Table 8 shows the quantity and cost of each kind of fuel used in blast furnaces, rolling mills and steel works, and forges and bloomeries in 1880, 1890, and 1900.

TABLE 8.—IRON AND STEEL: QUANTITY AND COST OF FUEL CONSUMED IN THE DIFFERENT BRANCHES, 1880 TO 1900.

| | Year. | TOTAL. | | BLAST FURNACES. | | ROLLING MILLS AND STEEL WORKS. | | FORGES AND BLOOMERIES. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. |
| Total | 1900 | ..... | [2]$66,652,344 | ..... | $44,221,702 | ..... | $22,342,390 | ..... | $88,252 |
| | 1890 | ..... | 55,561,749 | ..... | 37,884,383 | ..... | 17,397,434 | ..... | 279,932 |
| | 1880 | ..... | 35,969,873 | ..... | 21,917,002 | ..... | 13,202,597 | ..... | 850,274 |
| Anthracite coal and culm | 1900 | 1,830,582 | 3,518,113 | 886,564 | 2,297,419 | 944,018 | 1,220,694 | ..... | ..... |
| | 1890 | 2,655,280 | 6,654,420 | 1,796,854 | 5,165,761 | 858,071 | 1,487,713 | 355 | 946 |
| | 1880 | 2,966,517 | 9,889,037 | 2,334,984 | 8,012,755 | 631,229 | 1,875,062 | 304 | 1,220 |
| Bituminous coal and slack | 1900 | 11,777,834 | 15,783,887 | 832,235 | 1,101,312 | 10,944,046 | 14,679,804 | 1,553 | 2,771 |
| | 1890 | 5,110,187 | 10,426,030 | 491,971 | 759,522 | 4,617,055 | 9,663,208 | 1,161 | 3,300 |
| | 1880 | 5,052,727 | 12,610,440 | 939,065 | 2,095,887 | 4,112,222 | 10,510,255 | 1,440 | 4,298 |
| Coke | 1900 | 15,525,103 | 40,991,400 | 14,697,797 | 38,976,770 | 827,246 | 2,014,390 | 60 | 240 |
| | 1890 | 8,600,347 | 28,752,972 | 8,248,156 | 27,435,780 | 350,937 | 1,311,588 | 1,254 | 5,604 |
| | 1880 | 2,033,532 | 8,743,382 | 1,900,228 | 8,129,240 | 127,326 | 582,901 | 5,978 | 31,241 |
| Charcoal[3] | 1900 | 35,209,887 | 2,101,787 | 31,421,585 | 1,846,201 | 2,250,022 | 170,345 | 1,538,280 | 85,241 |
| | 1890 | 74,499,202 | 5,037,175 | 67,672,156 | 4,523,320 | 2,770,611 | 243,773 | 4,056,435 | 270,082 |
| | 1880 | 69,592,091 | 4,726,114 | 53,909,828 | 3,679,120 | 2,667,902 | 234,379 | 13,014,361 | 812,615 |
| Oil, used for fuel[4] | 1900 | 1,302,615 | 1,158,748 | ..... | ..... | 1,302,615 | 1,158,748 | ..... | ..... |
| | 1890 | 1,859,138 | 1,124,206 | ..... | ..... | 1,859,138 | 1,124,206 | ..... | ..... |
| | 1880 | 853 | 900 | ..... | ..... | ..... | ..... | 853 | 900 |
| Natural gas | 1900 | ..... | 3,098,409 | ..... | ..... | ..... | 3,098,409 | ..... | ..... |
| | 1890 | ..... | 3,566,946 | ..... | ..... | ..... | 3,566,946 | ..... | ..... |
| | 1880 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

[1] Gross ton of 2,240 pounds. [2] See explanation on page 17 of text concerning amount paid for freight. [3] Bushels. [4] Barrels.

Analyzing Table 8 it is found that the total consumption of anthracite and bituminous coal and coke by iron and steel establishments in the census year 1900 amounted to 29,133,519 tons, compared with 16,365,814 tons in 1890 and 10,052,776 tons in 1880. Of these totals the blast furnaces consumed 16,416,596 tons in 1900, against 10,536,981 tons in 1890 and 5,174,277 tons in 1880; the rolling mills and steel works, 12,715,310 tons in 1900, against 5,826,063 tons in 1890 and 4,870,777 tons in 1880; and the forges and bloomeries 1,613 tons in 1900, against 2,770 tons in 1890 and 7,722 tons in 1880.

The total consumption of anthracite coal in 1900 by the three branches named in the table amounted to only 1,830,582 tons, compared with 2,655,280 tons in 1890 and 2,966,517 tons in 1880. The loss was almost wholly in the blast-furnace industry, which decreased its consumption from 1,796,854 tons in 1890 to 886,564 tons in 1900, a loss of 910,290 tons. In 1880 the quantity consumed was 2,334,984 tons, or 1,448,420 tons greater than in 1900. The great decrease in 1900 compared with 1890 was caused entirely by the increased use of coke in the manufacture of pig iron. The rolling mills and steel works show a slight increase in the use of anthracite coal for fuel purposes in 1900 compared with 1890, the consumption amounting to 944,018 tons in the former year, and to 858,071 tons in the latter year. In 1880 the quantity consumed by this branch of the iron and steel industry was 631,229 tons.

The total consumption of bituminous coal in 1900 was more than double that of 1890, the figures being 11,777,834 tons for the year first named, against 5,110,187 tons for the year last named, an increase of 6,667,647 tons. In 1880 the total consumption was 5,052,727 tons, or 57,460 tons less than in 1890. Of the total quantity consumed in 1900, 832,235 tons were reported by blast furnaces, 10,944,046 tons by rolling mills and steel works, and 1,553 tons by forges and bloomeries. The increased consumption in 1900 was almost entirely by rolling mills and steel works. In 1890 the blast furnaces consumed 491,971 tons; the rolling mills and steel works, 4,617,055 tons; and the forges and bloomeries, 1,161 tons. For 1880 the following figures were reported: Blast furnaces, 939,065 tons; rolling mills and steel works, 4,112,222 tons; and forges and bloomeries, 1,440 tons.

The total consumption of coke, as shown in the table, amounted in 1900 to 15,525,103 tons, compared with 8,600,347 tons in 1890 and 2,033,532 tons in 1880. The increased consumption in 1900 over 1890 was 6,924,756 tons, and over 1880 it was 13,491,571 tons. Of the total consumption of coke in 1900, however, only 827,306 tons were reported by rolling mills and steel works and forges and bloomeries, the blast-furnace industry consuming the remainder, as will be seen by the following figures: Blast furnaces, 14,697,797 tons; rolling mills and steel works, 827,246 tons; and forges and bloomeries, 60 tons. In 1890 the consumption reported was: Blast furnaces, 8,248,156 tons; rolling mills and steel works, 350,937 tons; and bloomeries and forges, 1,254 tons. And for 1880 it was: Blast furnaces, 1,900,228 tons; rolling mills and steel works, 127,326 tons; and forges and bloomeries, 5,978 tons.

The consumption of charcoal decreased in 1900 more than one-half compared with 1890, and almost one-half compared with 1880. The falling off was chiefly in the blast-furnace industry, but decreases are also shown in the other two branches under review. For 1900 the consumption reported was 35,209,887 bushels, against 74,499,202 bushels in 1890 and 69,592,091 bush-

els in 1880. Of the total consumption in 1900 the blast furnaces reported 31,421,585 bushels, the rolling mills and steel works 2,250,022 bushels, and the forges and bloomeries 1,538,280 bushels. In 1890 the blast furnaces consumed 67,672,156 bushels, the rolling mills and steel works 2,770,611 bushels, and the forges and bloomeries 4,056,435 bushels, and in 1880 their consumption amounted to 53,909,828 bushels, 2,667,902 bushels, and 13,014,361 bushels, respectively. The consumption of charcoal by rolling mills and steel works was practically the same in 1900 as in 1880, the difference amounting to only 417,880 bushels.

The use of oil for fuel shows a decrease of 556,522 barrels in 1900 compared with 1890. In 1880 the quantity consumed was reported as 853 barrels, all used by forges and bloomeries. In 1890 and in 1900 all the oil used for fuel was reported by rolling mills and steel works.

The quantity of natural gas used for fuel was not ascertained in 1900, but the cost shows a decrease of $468,537 compared with 1890, the figures for the two periods being as follows: 1900, $3,098,409; 1890, $3,566,946. Almost all the natural gas reported in the two periods named was consumed by rolling mills and steel works. In 1880 the number of establishments using natural gas for fuel was very small, and apparently the quantity and cost were not separately reported.

### CONSUMPTION OF IRON ORE, MILL CINDER, AND FLUXING MATERIAL.

Table 9 shows the quantity and cost of iron ore, mill cinder, and fluxing material consumed in the manufacture of iron and steel in the census years 1880, 1890, and 1900. In comparing the cost of these materials as reported for 1900 with the cost reported for 1880 and 1890, it is again necessary to mention the fact that the figures given for 1900 include only a part of the freight charges, while those for 1880 and 1890 include all freight charges.

TABLE 9.—IRON AND STEEL: QUANTITY AND COST OF IRON ORE, MILL CINDER, AND FLUXING MATERIAL CONSUMED IN THE DIFFERENT BRANCHES, 1880 TO 1900.

| | Year. | TOTAL. | | BLAST FURNACES. | | ROLLING MILLS AND STEEL WORKS. | | FORGES AND BLOOMERIES. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. |
| Total | 1900 | 34,649,109 | $76,089,080 | 34,302,799 | $74,740,271 | 340,028 | $1,326,395 | 6,282 | $22,414 |
| | 1890 | 21,725,698 | 74,254,942 | 21,189,707 | 70,789,216 | 519,199 | 3,355,139 | 16,792 | 110,587 |
| | 1880 | 10,029,378 | 39,974,700 | 9,624,893 | 36,663,281 | 333,405 | 2,779,879 | 71,080 | 531,540 |
| Iron ore | 1900 | 25,722,090 | 67,257,063 | 25,375,780 | 65,908,254 | 340,028 | 1,326,395 | 6,282 | 22,414 |
| | 1890 | 15,558,412 | 66,971,256 | 15,022,421 | 63,505,530 | 519,199 | 3,355,139 | 16,792 | 110,587 |
| | 1880 | 6,883,667 | 36,516,697 | 6,479,182 | 33,205,278 | 333,405 | 2,779,879 | 71,080 | 531,540 |
| Mill cinder, scrap, etc | 1900 | 1,600,313 | 3,772,385 | 1,600,313 | 3,772,385 | ..... | ..... | ..... | ..... |
| | 1890 | 1,145,599 | 3,086,808 | 1,145,599 | 3,086,808 | ..... | ..... | ..... | ..... |
| | 1880 | 316,114 | 910,667 | 316,114 | 910,667 | ..... | ..... | ..... | ..... |
| Fluxing material | 1900 | 7,326,706 | 5,059,632 | 7,326,706 | 5,059,632 | ..... | ..... | ..... | ..... |
| | 1890 | 5,021,687 | 4,196,878 | 5,021,687 | 4,196,878 | ..... | ..... | ..... | ..... |
| | 1880 | 2,829,597 | 2,547,336 | 2,829,597 | 2,547,336 | ..... | ..... | ..... | ..... |

[1] Gross ton of 2,240 pounds.

The total consumption of iron ore, as shown above, was 25,722,090 tons in 1900, compared with 15,558,412 tons in 1890 and 6,883,667 tons in 1880, the increase in 1900 over 1890 amounting to 10,163,678 tons and over 1880 to 18,838,423 tons. Of the total reported for 1900, the blast furnaces consumed 25,375,780 tons, the rolling mills and steel works 340,028 tons, and the forges and bloomeries 6,282 tons, compared with a consumption in 1890 by blast furnaces of 15,022,421 tons, by rolling mills and steel works of 519,199 tons, and by forges and bloomeries of 16,792 tons. In 1880 the iron ore consumed by blast furnaces amounted to 6,479,182 tons, by rolling mills and steel works to 333,405 tons, and by forges and bloomeries to 71,080 tons. The decreased consumption of iron ore by rolling mills and steel works in 1900 compared with 1890 is largely due to the decrease in the number of active puddling furnaces and the increased use of steel.

The total consumption of mill cinder by blast furnaces amounted to 1,600,313 tons in 1900, compared with 1,145,599 tons in 1890 and 316,114 tons in 1880. The consumption of 1900 increased over that of 1890 by 454,714 tons.

In 1900 the quantity of fluxing material used by blast furnaces, which includes limestone, dolomite, oyster shells, etc., amounted to 7,326,706 tons, against 5,021,687 tons in 1890 and 2,829,597 tons in 1880.

### CONSUMPTION OF IRON AND STEEL.

In the two preceding tables the details given relate entirely to the quantity and cost of fuel, iron ore, mill cinder, and fluxing material consumed during the three census periods. Table 10 shows the quantity and cost of pig iron, scrap iron and steel, purchased muck bar, purchased steel ingots, purchased wire rods, and other

forms of iron and steel consumed by rolling mills, steel works, and forges and bloomeries in 1880, 1890, and 1900. Here, again, in comparing the cost of these materials in 1900 with the cost reported for 1880 and 1890, the fact must not be overlooked that the freight charges have been in part omitted from the individual figures for 1900, while in the cost reported for both 1880 and 1890 they have been included in full. The scrap iron and steel mentioned in the table embraces only waste materials purchased and consumed by iron and steel works, and does not include the scrap iron or steel which is regularly produced at all iron and steel plants, and which is usually consumed by the works turning it out.

TABLE 10.—IRON AND STEEL: QUANTITY AND COST OF IRON AND STEEL USED AS MATERIAL, 1880 TO 1900.

| CLASSES. | DATE OF CENSUS. | | | | | |
|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | |
| | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. |
| Total | 18,551,442 | $321,146,512 | 8,735,761 | $179,288,771 | 3,811,289 | $113,424,247 |
| Spiegeleisen, ferromanganese, and all other pig iron | 10,411,281 | 151,064,348 | 5,854,252 | 105,492,718 | 2,395,333 | 62,814,151 |
| Old iron or steel rails, and other scrap iron or steel | 4,126,980 | 66,852,621 | 1,747,590 | 36,460,815 | 1,206,818 | 37,908,350 |
| Purchased hammered iron ore blooms, pig or scrap blooms, and imported Swedish billets and bars | 32,720 | 1,150,575 | 49,867 | 2,329,138 | 92,261 | 5,993,145 |
| Purchased muck or scrap bar | 161,329 | 4,535,939 | 209,534 | 6,252,594 | 47,995 | 2,369,544 |
| Purchased iron or steel ingots, blooms, billets, tin plate bars, sheet bars, or slabs (except imported Swedish billets and bars) | 3,682,407 | 92,123,412 | 874,518 | 28,753,506 | 68,882 | 4,339,057 |
| Purchased wire rods | 136,725 | 5,419,617 | [2] | [2] | [2] | [2] |

[1] Gross ton of 2,240 pounds. [2] Not reported separately.

The quantity of spiegeleisen, ferromanganese, and pig iron consumed by rolling mills, steel works, and forges and bloomeries amounted in 1900 to 10,411,281 tons, compared with 5,854,252 tons in 1890 and 2,395,333 tons in 1880, an increase in 1900 over 1890 of 4,557,029 tons, and over 1880 of 8,015,948 tons. The consumption of old iron and steel rails and other scrap iron or steel also increased considerably in 1900 compared with the two preceding census years, the quantity consumed in 1900 amounting to 4,126,980 tons, compared with 1,747,590 tons in 1890 (an increase of 2,379,390 tons) and 1,206,818 tons in 1880 (an increase of 2,920,162 tons in the twenty years). The consumption of purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets or bars shows a decline in 1900 compared with both 1890 and 1880, the decrease amounting to 17,147 tons in 1900 compared with 1890 and to 59,541 tons compared with 1880.

The decline in this country of the manufacture of iron ore blooms and pig and scrap blooms for sale has already been mentioned. The consumption of purchased muck or scrap bar also shows a decrease, having fallen from 209,534 tons in 1890 to 161,329 tons in 1900, a loss of 48,205 tons. In 1880 the quantity used amounted to only 47,995 tons. The consumption of purchased iron and steel ingots, blooms, billets, tin plate bars, sheet bars, and slabs (omitting the imported Swedish billets and bars mentioned above, all of which are used for special purposes) shows a very great increase in 1900 over 1890, the figures for the former year being 3,682,407 tons and those for the latter year 874,518 tons. In 1880 the consumption amounted to only 68,882 tons. In 1900 the purchased wire rods consumed by rolling mills amounted to 136,725 tons. In 1890 and 1880 the purchased wire rods consumed were not separately reported.

As a rule the iron and steel manufacturing sections of the United States do not contain all of the raw materials essential to a full development of the different branches of the industry. The Southern states have vast deposits of iron ore, coal, limestone, and dolomite, all lying within short distances of each other. Certain grades of pig iron can, therefore, be made in many of these states at a much lower cost per ton than is possible in other sections of the country. The ores of the Southern states, however, are not adapted to the manufacture of pig iron suitable for making steel by the acid Bessemer process, by which in the census year 1900 almost three-fourths of the crude steel made in the United States was produced. A considerable quantity of basic open-hearth steel was, however, manufactured in 1900 by one of the Southern states (Alabama) from pig iron made within its own borders. In the coming years this state will probably become a fairly large producer of steel by this process.

Michigan, Wisconsin, and Minnesota contain immense deposits of iron ore, these three states producing about 85 per cent of the total quantity annually mined in the whole country. Much of this ore is especially adapted for the manufacture of pig iron suitable for making Bessemer steel. But neither of the three states named has a mineral fuel supply that could be economically used in the manufacture of pig iron. All of the pig iron made in Michigan is manufactured with charcoal as fuel, but even this fuel is far from abundant in some parts of the state. Michigan has not produced pig iron with mineral fuel since 1877, but Wisconsin had several furnaces using this fuel located within its borders

in 1900, all of which obtained their supply of coke from Pennsylvania or West Virginia.

Pennsylvania, which is far in the lead of other states as a manufacturer of pig iron with mineral fuel, has been endowed by nature with boundless stores of both anthracite and bituminous coal. But, with one exception, the iron-ore deposits of the state are small, the total quantity mined in 1900 amounting to less than 1,000,000 tons, over one-half of which was produced by one district. This state is, therefore, compelled to draw largely upon other sections of the country for the ore for its blast furnaces, the greater part coming from the Lake Superior region over 1,000 miles away. Illinois, on the other hand, while located much nearer than Pennsylvania to the Lake Superior iron-ore mines, obtains the bituminous fuel for its blast furnaces from the Connellsville region in Pennsylvania, and from the Pocahontas Flat Top region in West Virginia, hundreds of miles away. The payment of freight charges by Pennsylvania blast furnaces on iron ore from the distant Lake Superior region, and by Illinois furnaces on coke from the far away Connellsville and Flat Top regions, therefore, constitutes a very important item in the cost of the manufacture of pig iron in the two states named.

New York, New Jersey, and West Virginia are also large consumers of Lake Superior ore, and all three states use considerable quantities of Connellsville coke for fuel, the two states first named frequently mixing the coke with anthracite coal for blast furnace use.

### PRODUCTION OF IRON AND STEEL.

Table 11 shows the total production of all kinds of iron and steel in 1900, compared with the production in 1890 and 1880, and the percentage of increase or decrease.

TABLE 11.—IRON AND STEEL: TONS OF CLASSIFIED PRODUCTS, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

| CLASSES. | TONS.[1] | | | PER CENT OF INCREASE. | |
|---|---|---|---|---|---|
| | 1900 | 1890 | 1880 | 1890 to 1900. | 1880 to 1890. |
| Total | 29,507,860 | 16,264,478 | 6,486,733 | 81.4 | 150.7 |
| Products of blast furnaces | 14,452,234 | 8,845,185 | 3,375,912 | 63.4 | 162.0 |
| Products of rolling mills and steel works | 15,040,129 | 7,388,244 | 3,046,038 | 103.6 | 142.6 |
| Products of forges and bloomeries | 15,497 | 31,049 | 64,783 | [2]50.1 | [2]52.1 |

[1] Gross ton of 2,240 pounds. [2] Decrease.

The total production of all kinds of iron and steel in 1900 amounted to 29,507,860 tons, compared with 16,264,478 tons in 1890 and 6,486,733 tons in 1880. The increase in 1900 over 1890 was 13,243,382 tons, or 81.4 per cent, and the increase in 1890 over 1880 was 9,777,745 tons, or 150.7 per cent. Compared with 1880 the increase in 1900 amounted to 23,021,127 tons, or 354.9 per cent. The increased production in 1900 over 1890 was more than twice the total production of 1880, and the total production in 1900 exceeded by 6,756,649 tons the combined production of 1890 and 1880. These figures graphically exhibit the wonderful growth of the iron and steel industry during the last twenty years.

The production of pig iron in 1900, including spiegeleisen, ferromanganese, and castings made direct from the blast furnace, amounted to 14,452,234 tons, compared with 8,845,185 tons in 1890, an increase of 5,607,049 tons, or 63.4 per cent. In 1890 the increased production over 1880 was 5,469,273 tons, or 162 per cent. Compared with 1880 the increase in 1900 amounted to 11,076,322 tons, or 328.1 per cent. The total production of 1900 exceeded by 2,231,137 tons the combined production of 1880 and 1890.

The production of rolled and forged iron and steel and of direct steel castings by rolling mills and steel works in 1900 exceeded by 4,605,847 tons, or 44.1 per cent, the combined production of both 1890 and 1880. These figures include the quantity of steel ingots produced for sale. Compared with 1890 the production in 1900 increased 7,651,885 tons, or 103.6 per cent, while compared with 1880 the production in 1890 increased 4,342,206 tons, or 142.6 per cent. If the production of 1900 is compared with that of 1880, an increase of 11,994,092 tons, or 393.8 per cent, is shown for the twenty years.

The production of blooms and hammered bar iron for sale by forges and bloomeries shows a heavy decline in 1900 compared with 1890 and 1880. In the ten years from 1890 to 1900 this decline amounted to 15,552 tons, or 50.1 per cent, and from 1880 to 1890 it amounted to 33,734 tons, or 52.1 per cent. In the twenty years from 1880 to 1900 the decrease amounted to 49,286 tons, or 76.1 per cent.

While the figures given above for pig iron and for castings produced direct from the blast furnace are full and complete for the three periods named, and contain no duplications whatever, it should be explained that in reaching grand totals for the three branches of the iron and steel industry under review, serious duplications are unavoidable, both in quantities and values. In the quantity and value of the steel castings reported, of the rolled and forged products manufactured, and of the hammered blooms and bars made, there is always a duplication of the quantity and value of the pig iron consumed in the manufacture of these products. Many rolling mills and steel works produce for sale large quantities of partly finished rolled materials, such as muck and scrap bar, billets, slabs, sheet bars, tin-plate bars, etc., these partly finished products being sold to other establishments, which roll them into finished forms. As a result, the quantity and value of the partly finished products are reported to the Census Office first

by the establishment by which they were originally produced and again by the establishment by which they are rolled into finished forms. As all census statistics are compiled by counties as well as by states (and frequently by cities as well), there is no possible way by which these duplications can be avoided if the total quantity and value of the iron and steel produced in each county and in each state is to be given separately. In reaching a grand total for both quantities and values for cities, for counties, for states, and for the country at large the products of each individual establishment have, therefore, been included, whether these products are of the most highly finished character or are partly finished and suitable only for remanufacture.

As has been already stated, the pig iron consumed by forges or bloomeries is also duplicated in the grand totals given in Table 11, as well as the blooms and bars produced for sale, practically all of which were manufactured into finished products by rolling mills or steel plants. It will thus be seen that not only are the grand totals for iron and steel for the three years covered by the table greatly in excess of the quantity actually produced, but the values reported are also very much in excess of the actual value of the finished products, in very many instances quantities and values appearing twice and in some cases even three times. As similar methods of tabulation were employed in previous censuses, however, the value of the figures for comparative purposes for the three periods given in the table is not invalidated.

Tables 12 and 13 show the counties which produced during the census year 1900 over 60,000 tons of pig iron, rolled and forged iron and steel, direct steel castings, and forged or hammered blooms or bars for sale, ranked in the order of their prominence in 1900, the production in the year named being compared with their output in 1890 and 1880.

In Table 12 the counties which produced in 1900 iron and steel in excess of 100,000 tons are given, while in Table 13 only those counties which in 1900 produced less than 100,000 tons but more than 60,000 tons appear.

TABLE 12.—IRON AND STEEL: COUNTIES PRODUCING 100,000 TONS[1] AND OVER IN 1900, WITH RANK OF COUNTIES, 1880 TO 1900.

| Rank in 1900. | COUNTIES. | TONS.[1] | | |
|---|---|---|---|---|
| | | 1900 | 1890 | 1880 |
| 1 | Allegheny, Pa | 8,203,715 | 3,389,329 | 757,273 |
| 2 | Cook, Ill | 1,976,685 | 1,030,588 | 221,356 |
| 3 | Mahoning, Ohio | 1,364,582 | 559,180 | 196,390 |
| 4 | Jefferson, Ala | 1,061,540 | 610,763 | 23,261 |
| 5 | Cuyahoga, Ohio | 968,801 | 495,399 | 187,816 |
| 6 | Cambria, Pa | 927,676 | 509,223 | 232,268 |
| 7 | Mercer, Pa | 841,800 | 440,198 | 163,287 |
| 8 | Dauphin, Pa | 760,864 | 512,369 | 199,711 |
| 9 | Will, Ill | 736,097 | 329,710 | 75,084 |
| 10 | Lawrence, Pa | 699,414 | 234,210 | 78,967 |
| 11 | Lackawanna, Pa | 572,030 | 491,189 | 135,065 |
| 12 | Belmont, Ohio | 496,858 | 162,389 | 50,172 |
| 13 | Jefferson, Ohio | 495,323 | 261,492 | 36,215 |
| 14 | Montgomery, Pa | 480,948 | 304,352 | 150,561 |
| 15 | Baltimore, city and county, Md | 447,432 | 84,447 | 62,450 |
| 16 | Lorain, Ohio | 403,533 | 45,318 | (2) |

[1] Gross ton of 2,240 pounds. [2] No active establishments reported.

TABLE 12.—IRON AND STEEL: COUNTIES PRODUCING 100,000 TONS[1] AND OVER IN 1900, WITH RANK OF COUNTIES, 1880 TO 1900—Continued.

| Rank in 1900. | COUNTIES. | TONS.[1] | | |
|---|---|---|---|---|
| | | 1900 | 1890 | 1880 |
| 17 | Lehigh, Pa | 385,109 | 367,131 | 290,067 |
| 18 | Lebanon, Pa | 376,855 | 359,938 | 65,312 |
| 19 | Berks, Pa | 364,270 | 299,556 | 190,696 |
| 20 | Marshall, W. Va | 317,989 | 184,301 | 33,661 |
| 21 | Franklin, Ohio | 315,798 | 29,683 | 20,440 |
| 22 | Milwaukee, Wis | 309,724 | 155,963 | 114,456 |
| 23 | Lawrence, Ohio | 248,908 | 85,218 | 63,209 |
| 24 | Westmoreland, Pa | 246,299 | 36,359 | 16,341 |
| 25 | Pueblo, Colo | 231,902 | 30,207 | (2) |
| 26 | Ohio, W. Va | 223,117 | 155,629 | 75,685 |
| 27 | Trumbull, Ohio | 187,494 | 220,683 | 65,508 |
| 28 | Chester, Pa | 179,787 | 134,720 | 69,967 |
| 29 | Northampton, Pa | 179,477 | 446,863 | 288,288 |
| 30 | Columbiana, Ohio | 156,526 | 94,440 | 39,384 |
| 31 | Madison, Ind | 147,566 | 21,052 | (2) |
| 32 | Boyd, Ky | 146,868 | 47,584 | 33,589 |
| 33 | Alleghany, Va | 145,176 | 71,806 | 7,533 |
| 34 | Niagara, N. Y | 136,285 | 22,780 | (2) |
| 35 | Tuscarawas, Ohio | 128,039 | 38,084 | 14,041 |
| 36 | Erie, N. Y | 125,488 | (2) | 22,335 |
| 37 | Armstrong, Pa | 110,799 | 78,633 | 8,304 |
| 38 | Colbert, Ala | 109,595 | 82,496 | (2) |
| 39 | Worcester, Mass | 106,466 | 87,939 | 26,946 |
| 40 | Delaware, Ind | 102,620 | 11,955 | (2) |

[1] Gross ton of 2,240 pounds. [2] No active establishments reported.

TABLE 13.—IRON AND STEEL: COUNTIES PRODUCING OVER 60,000 BUT UNDER 100,000 TONS[1] IN 1900, WITH RANK OF COUNTIES, 1880 TO 1900.

| Rank in 1900. | COUNTIES. | TONS.[1] | | |
|---|---|---|---|---|
| | | 1900 | 1890 | 1880 |
| 1 | Montour, Pa | 97,069 | 108,442 | 71,240 |
| 2 | Pulaski, Va | 92,697 | 45,900 | 45 |
| 3 | Lancaster, Pa | 88,545 | 114,117 | 77,696 |
| 4 | Wayne, Mich | 83,808 | 102,828 | 56,739 |
| 5 | Fayette, Pa | 81,752 | 89,855 | 33,132 |
| 6 | Philadelphia, Pa | 77,225 | 73,298 | 58,913 |
| 7 | Rhea, Tenn | 76,804 | 57,547 | (2) |
| 8 | St. Louis, city and county, Mo | 75,849 | 81,475 | 91,646 |
| 9 | Marion, Tenn | 75,627 | 63,210 | 16,034 |
| 10 | Roanoke, Va | 73,639 | 62,425 | (2) |
| 11 | Jackson, Ohio | 70,962 | 42,294 | 36,684 |
| 12 | Bedford, Pa | 69,272 | 42,030 | 9,282 |
| 13 | Bell, Ky | 66,384 | (2) | (2) |
| 14 | Warren, N. J | 65,755 | 87,138 | 68,413 |
| 15 | Delaware, Pa | 62,702 | 92,990 | 8,918 |
| 16 | Antrim, Mich | 60,251 | 17,852 | 11,585 |

[1] Gross ton of 2,240 pounds. [2] No active establishments reported.

There were 40 counties which produced over 100,000 tons of iron and steel in 1900, compared with 27 in 1890. These 40 counties were located in 13 states. The 27 producing counties in 1890 were located in 8 states. Of the 27 counties reporting over 100,000 tons in 1890, only 26 appear in Table 12, the production in Rensselaer county, N. Y., having fallen below 60,000 tons for 1900. Four counties in 1900, namely, Allegheny county, in Pennsylvania, Cook county, in Illinois, Mahoning county, in Ohio, and Jefferson county, in Alabama, produced almost as much iron and steel as the combined production of the remaining 36 counties, the figures being as follows: Total production of the 4 counties named, 12,606,522 tons; of the remaining 36 counties, 12,812,933 tons. Compared with 1890 Allegheny county increased its production in 1900 by 4,814,386 tons, or 142 per cent; Cook county by 946,097 tons, or 91.8 per cent; Mahoning county by [illegible]402 tons, or 144 per cent; and Jefferson county

by 450,777 tons, or 73.8 per cent. Compared with 1880 the increase is almost marvelous, as the total production of the 4 counties in that year amounted to only 1,198,780 tons. The comparative figures follow: Allegheny county, increase in 1900 over 1880, 7,446,442 tons, or 983.3 per cent; Cook county, 1,754,829 tons, or 791 per cent; Mahoning county, 1,168,192 tons, or 594.8 per cent; and Jefferson county, 1,038,279 tons, or 4,463.6 per cent. The increase in production in Jefferson county and in Allegheny county is especially noticeable.

Taking up the remaining 36 counties in the 1900 column in the table, it is found that 13 are located in Pennsylvania, 1 in Illinois, 9 in Ohio, 1 in Alabama, 1 in Maryland, 2 in West Virginia, 1 in Wisconsin, 1 in Colorado, 2 in Indiana, 1 in Kentucky, 1 in Virginia, 2 in New York, and 1 in Massachusetts. Of these counties 2 produced less than 1,000,000 tons but over 900,000 tons, 1 over 800,000 tons but less than 900,000 tons, 2 over 700,000 tons but less than 800,000 tons, 1 less than 700,000 tons but over 600,000 tons, 1 less than 600,000 tons but over 500,000 tons, 5 less than 500,000 tons but over 400,000 tons, 6 less than 400,000 tons but over 300,000 tons, 4 less than 300,000 tons but over 200,000 tons, and 14 less than 200,000 tons but over 100,000 tons. With two exceptions, namely, Trumbull county, in Ohio, and Northampton county, in Pennsylvania, all of the counties named in the table increased their production in 1900 over 1890. In Trumbull county the decline was from 220,683 tons in 1890 to 187,494 tons in 1900, a falling off of 33,189 tons. In Northampton county it was from 446,863 tons in 1890 to 179,477 tons in 1900, a decrease of 267,386 tons, caused almost entirely by the idleness during the census year of the Bessemer converters of one of the largest establishments in that county.

In the census year 1900 there were 16 counties, located in 8 states, which produced less than 100,000 tons but over 60,000 tons of iron and steel, as shown by Table 13.

Seven of the counties enumerated in this table decreased their production of iron and steel in 1900 compared with 1890, and two, namely, St. Louis city and county, in Missouri, and Warren county, in New Jersey, made less iron and steel in 1900 than they did in 1880, the falling off in St. Louis city and county amounting to 15,797 tons, and in Warren county to 2,658 tons.

### NUMBER, EQUIPMENT, AND CAPACITY OF IRON AND STEEL ESTABLISHMENTS.

Table 14 shows the number of active and idle blast furnaces, rolling mills and steel works, and forges and bloomeries in the United States in 1900 compared with the number of similar establishments reported in 1890 and 1880, and the equipment and capacity of the plants for the years named.

TABLE 14.—IRON AND STEEL: NUMBER, EQUIPMENT, AND CAPACITY IN GROSS TONS OF ACTIVE AND IDLE ESTABLISHMENTS, 1880 TO 1900.

| | 1900 | 1890 | 1880 |
|---|---|---|---|
| Blast furnaces: | | | |
| Number of establishments | 273 | 377 | 483 |
| Number of completed furnaces | 399 | 559 | 681 |
| Total daily capacity, tons of pig iron | 58,569 | 37,889 | 17,186 |
| Rolling mills and steel works: | | | |
| Number of establishments | 476 | 429 | 391 |
| Total daily capacity, finished rolled and forged products, tons, double turn | 90,122 | 41,576 | 19,730 |
| Bessemer steel establishments, included above | 42 | 51 | 11 |
| Bessemer steel converters, number | 91 | 97 | 24 |
| Total daily capacity, tons of ingots, double turn | 38,420 | 19,285 | 3,988 |
| Open-hearth steel establishments, included above | 96 | 58 | 25 |
| Open-hearth furnaces, number | 331 | 129 | 37 |
| Total daily capacity, tons of ingots, double turns | 19,030 | 3,608 | 738 |
| Acid furnaces, number | 152 | ..... | ..... |
| Total daily capacity, tons of acid ingots, double turn | 6,419 | ..... | ..... |
| Basic furnaces, number | 179 | ..... | ..... |
| Total daily capacity, tons of basic ingots, double turn | 12,611 | ..... | ..... |
| Crucible steel establishments, included above | 40 | 47 | 37 |
| Number of pots which can be used at a heat | 2,619 | 2,606 | 2,691 |
| Forges and bloomeries: | | | |
| Number of establishments | 14 | 32 | 118 |
| Total daily capacity, tons of blooms, billets, and bars, double turn | 143 | 263 | 464 |

As shown above, there was a heavy decrease in 1900, compared with both 1890 and 1880, in the number of establishments which were engaged in the manufacture of pig iron. This decrease was largely caused by the consolidation since 1880, and especially since 1890, of many furnaces under one management. A marked falling off is also shown in the number of completed blast furnaces, due chiefly to the dismantling of stacks which were badly located and which were equipped with antiquated blowing machinery. The daily capacity of the completed furnaces in 1900, however, was very much greater than that of the completed furnaces in 1890.

The healthy growth shown in the number of establishments which operated rolling mills and steel works in 1900 compared with 1890 and 1880 has already been alluded to. The increase in the daily capacity of finished rolled and forged products in this branch of the iron and steel industry amounted to 116.8 per cent in 1900 as compared with 1890. Compared with 1880, the increase in 1900 was 356.8 per cent.

The number of establishments equipped for the manufacture of Bessemer steel shows a loss of 9 in 1900 as compared with 1890, but a gain as compared with 1880. While the number of Bessemer converters decreased in 1900 compared with 1890, the total loss in the ten years being 6 converters, the capacity of the 91 converters reported for 1900 was almost double that of the 97 converters in existence in 1890. In the open-hearth steel industry the number of establishments increased from 25 in 1880 and 58 in 1890 to 96 in 1900. During the same period the number of furnaces advanced from 37 in 1880 to 129 in 1890 and to 331 in 1900. The total daily capacity of the open-hearth furnaces in 1900 was a little less than one-half of the daily capacity reported

by the Bessemer converters for that year, while in 1890 the capacity of the open-hearth furnaces was less than one-fifth of the Bessemer capacity. In 1880 the open-hearth capacity amounted to only 738 tons daily, while the Bessemer capacity was 3,988 tons. The fact that in 1890 the daily Bessemer capacity was almost the same as the daily open-hearth capacity in 1900 is worthy of attention. So also is the fact that in 1900 the daily capacity of the basic open-hearth furnaces was about double the capacity of the acid open-hearth furnaces. As will be shown later on, the entire growth of the basic open-hearth process has practically taken place during the last ten years, the total production in 1890 amounting to only 55,512 tons.

The manufacture of crucible steel has made but little progress in the United States since 1880, in which year the number of pots that could be used at a heat was 72 greater than in 1900. In the intervening twenty years, however, the production of crucible steel increased 36,356 tons (see Table 64). The number of crucible steel establishments was 37 in 1880, 47 in 1890, and 40 in 1900, a gain of three establishments compared with twenty years ago, but a loss of seven establishments compared with ten years ago.

### IRON AND STEEL INDUSTRY BY GEOGRAPHIC DIVISIONS.

Table 15 shows the leading statistics for the iron and steel industry, by geographic divisions, for the years 1880, 1890, and 1900. The New England states embrace Maine, Massachusetts, Connecticut, Rhode Island, New Hampshire, and Vermont; the Middle states embrace New York, New Jersey, Pennsylvania, and Delaware; the Southern states embrace Maryland, Virginia, West Virginia, North Carolina, Georgia, Alabama, Kentucky, Tennessee, and Texas, all of which manufacture iron or steel; and the Western states include all states west of Pennsylvania, not heretofore mentioned, which produced iron or steel during the years covered by the table. Active establishments only are included.

TABLE 15.—IRON AND STEEL: COMPARATIVE SUMMARY, BY GEOGRAPHIC DIVISIONS, 1880 TO 1900.[1]

| GEOGRAPHIC DIVISIONS. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. | Tons[2] of products. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | | |
| United States | 1900 | 669 | [3]$590,530,484 | 9,217 | $11,741,788 | 222,607 | $120,836,338 | $32,274,100 | $522,431,701 | $804,034,918 | 29,507,860 |
| | 1890 | 719 | [3]414,044,844 | [4]4,325 | [4]6,462,236 | 171,181 | 89,273,956 | 18,214,948 | 327,272,845 | 478,687,519 | 16,204,478 |
| | 1880 | 792 | 209,904,965 | ([5]) | ([5]) | 140,798 | 55,451,510 | ([6]) | 191,271,150 | 296,557,685 | 6,486,733 |
| New England states | 1900 | 18 | 21,778,391 | 187 | 305,046 | 8,248 | 4,515,060 | 1,224,618 | 10,141,357 | 18,303,510 | 203,265 |
| | 1890 | 32 | 13,224,150 | 199 | 297,157 | 6,645 | 3,224,318 | 413,578 | 9,286,050 | 15,105,441 | 216,643 |
| | 1880 | 49 | 10,490,408 | ([5]) | ([5]) | 8,654 | 3,357,911 | ([6]) | 9,518,570 | 14,558,627 | 190,161 |
| Middle states | 1900 | 352 | 359,821,093 | 5,719 | 7,192,690 | 126,060 | 69,569,423 | 19,636,385 | 308,765,127 | 475,845,093 | 16,111,525 |
| | 1890 | 390 | 256,833,069 | 2,484 | 3,747,602 | 106,108 | 56,166,425 | 11,324,830 | 199,225,674 | 294,048,406 | 9,475,941 |
| | 1880 | 440 | 132,814,213 | ([5]) | ([5]) | 75,055 | 31,348,225 | ([6]) | 113,432,592 | 180,484,560 | 4,011,380 |
| Southern states | 1900 | 97 | 46,089,040 | 719 | 989,800 | 21,890 | 8,560,814 | 2,299,084 | 41,133,966 | 63,771,161 | 3,468,680 |
| | 1890 | 109 | 43,051,652 | 550 | 806,415 | 17,051 | 6,863,185 | 2,110,129 | 27,047,767 | 39,982,152 | 2,051,057 |
| | 1880 | 130 | 21,942,311 | ([5]) | ([5]) | 19,728 | 5,916,868 | ([6]) | 13,739,624 | 23,006,074 | 549,317 |
| Western states | 1900 | 202 | 162,841,360 | 2,592 | 3,254,252 | 66,409 | 38,191,041 | 9,114,013 | 162,391,251 | 246,115,154 | 9,724,390 |
| | 1890 | 188 | 100,935,973 | 1,092 | 1,611,062 | 41,377 | 23,020,028 | 4,366,411 | 91,713,354 | 129,551,520 | 4,520,837 |
| | 1880 | 173 | 44,658,033 | ([5]) | ([5]) | 37,361 | 14,828,506 | ([6]) | 54,580,364 | 78,508,424 | 1,735,875 |

[1] This summary includes only active establishments.
[2] Gross ton of 2,240 pounds.
[3] Includes rented property valued in 1900 at $16,968,821; in 1890 at $8,278,058.
[4] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table.
[5] Not reported separately.
[6] Not reported.

### THE NEW ENGLAND STATES.

New England shows a decrease of 14 in the number of active establishments reported for 1900 compared with 1890, and a decrease of 31 compared with 1880. In capital invested there was an increase of $8,554,241 in 1900 compared with 1890, or 64.7 per cent. The wage-earners increased 1,603 in 1900 compared with 1890, or 24.1 per cent, and wages increased $1,290,742, or 40 per cent. For reasons already stated comparisons should not be made for 1900 or 1890 with 1880, for capital invested, wage-earners, and wages paid. Miscellaneous expenses increased $811,040 in 1900 compared with 1890. In 1880 expenses of this character were not reported. The cost of the materials used increased $855,307 in 1900 compared with 1890, or 9.2 per cent, and $622,787 compared with 1880, or 6.5 per cent. The value of products increased $3,198,069 in 1900 compared with 1890, or 21.2 per cent, and $3,744,883 compared with 1880, or 25.7 per cent.

In output there was a falling off of 13,378 tons in 1900 compared with 1890, a decrease of 6.2 per cent, but an increase compared with 1880 of 13,104 tons, or 6.9 per cent. The decrease in output in 1900 compared with 1890 was entirely in pig iron.

The total number of active blast furnace establishments in New England in 1900 was 2, compared with 7 in 1890 and 10 in 1880. The pig iron produced amounted to 13,487 tons in 1900, compared with 30,656 tons in 1890 and 27,640 tons in 1880. Additional details can not be given for 1900 without disclosing the operations of the two establishments active in that year.

The total number of establishments engaged in the production of steel or of rolled iron and steel in New England in 1900 was 16, compared with 25 in 1890 and 38 in 1880. The capital invested by these establishments in 1900 was $21,455,157, against $11,472,897 in 1890 and $8,511,408 in 1880. In the total for 1890 $115,000 of rented property are included. The average number of wage-earners employed was 8,179 in 1900, 6,447 in 1890, and 7,791 in 1880, who drew wages to the amount of $4,487,646 in 1900, $3,148,284 in 1890, and $3,068,388 in 1880. In 1900 the miscellaneous expenses amounted to $1,202,678, compared with $303,505 in 1890. In 1880 miscellaneous expenses were not collected. The cost of the materials used in 1900 amounted to $9,939,472, compared with $8,651,998 in 1890 and $8,838,874 in 1880. The value of products in 1900 was $17,973,135, against $14,219,003 in 1890 and $13,513,531 in 1880. The output in 1900 was 189,778 tons, against 185,986 tons in 1890 and 162,481 tons in 1880.

There were no forges or bloomeries in operation in New England in 1900 or 1890. In 1880 there were 3 establishments reported, of which, however, 1 only was active. This establishment had invested $5,000. It employed 8 hands, paid $564 in wages, expended $1,834 for materials, and produced blooms valued at $2,200.

One steel plant was being erected in New England in 1900. In 1890 and 1880 there were no plants for the manufacture of iron or steel in course of construction in any of the New England states.

Since the close of the census year 1900 the iron and steel industry of New England has shown a very encouraging growth. Down to the summer of 1902 at least 4 new rolling mills and steel plants had been practically completed. Three of these plants are equipped with open-hearth steel furnaces. Of the 4 plants, 3 have trains of rolls for the production of wire rods. The steel plants have an annual capacity of about 38,000 tons of ingots (24,500 tons of basic and 13,500 tons of acid).

In the rolling-mill department of the 3 plants, 135,000 tons of flat and round rods can be turned out annually. In addition 2 of the plants are equipped to manufacture wire and wire nails, their annual capacity for the products first named amounting to 52,500 tons, and for the products last named to 475,000 kegs of 100 pounds each. Two of the steel plants are located in Rhode Island and 1 in Massachusetts. The establishment which is not equipped with steel furnaces is located in Connecticut. The steel plant in Massachusetts produces castings only, and is not equipped with trains of rolls.

In addition to the enterprises named above, an established rolling mill at Bridgeport, Conn., is now adding several open-hearth steel furnaces to its works. Trains of rolls for the manufacture of billets are also being installed. Steel castings will be made as well as rolled products.

### THE MIDDLE STATES.

The Middle states show a decrease of 38 in the number of active establishments reported in 1900 compared with 1890, and of 88 compared with 1880. The capital invested, on the other hand, shows an increase in 1900 over 1890 of $102,988,624, or 40.1 per cent. In wage-earners there was an increase in 1900 over 1890 of 19,952, or 18.8 per cent, and in wages of $13,402,998, or 23.9 per cent. No comparisons are made with 1880 for these items. Miscellaneous expenses increased $8,311,555 in 1900 over 1890, or 73.4 per cent. The cost of the materials used in 1900 shows an increase over 1890 of $109,539,453, or 55 per cent, and over 1880 of $195,332,535, or 172.2 per cent, while the value of the products in 1900 was $181,796,687 greater than in 1890, or 61.8 per cent, and $295,360,533 greater than in 1880, or 163.6 per cent. In output the increase in 1900 over 1890 amounted to 6,635,584 tons, or 70 per cent, and over 1880 to 12,100,145 tons, or 301.6 per cent.

The number of active blast-furnace establishments reported by the Middle states in 1900 was 95, compared with 140 in 1890 and 179 in 1880. The amount of capital invested in 1900 was $81,328,706, against $68,896,144 in 1890, which includes rented property valued at $3,165,181 in the former year and $2,210,000 in the latter year. The wage-earners numbered 17,697 in 1900, compared with 17,662 in 1890; the wages paid, $8,962,622, against $7,905,567; and the miscellaneous expenses $3,648,228, against $3,163,843. No comparisons for any of the items named are made with 1880. The cost of the materials used in 1900 amounted to $69,590,971, against $63,115,306 in 1890 and $36,330,367 in 1880; while the value of products amounted to $109,167,847 in 1900, compared with $82,650,533 in 1890 and $55,818,738 in 1880. The pig iron made in 1900 amounted to 7,263,098 tons, against 4,782,932 tons in 1890 and 2,143,833 tons in 1880.

The number of establishments which produced steel ingots or castings, or rolled iron and steel, in the Middle states in 1900 was 251, compared with 231 in 1890 and 208 in 1880. In 1900 the capital invested by active establishments was $278,314,288, against $187,098,455 in 1890 and $75,538,948 in 1880. The totals for 1900 and 1890 include $10,518,736 and $978,000 of rented property, respectively. The average number of wage-earners employed in 1900 was 108,197, compared with 88,035 in 1890 and 55,631 in 1880. These employees were paid wages in 1900 to the amount of $60,533,857, against $48,095,793 in 1890 and $24,581,865 in 1880. The amount paid for miscellaneous expenses was $15,981,996 in 1900 and $8,107,807 in 1890. In 1880 expenses of this character were not ascertained. The cost of the materials used in 1900 was $238,913,174, compared with $135,338,945 in 1890 and $74,957,356 in 1880, while the value of the products in 1900 amounted to $366,281,294, compared with $210,389,379 in 1890 and $121,421,562 in 1880. The production of rolling

mills and steel works amounted to 8,837,010 tons in 1900, compared with 4,666,710 tons in 1890 and 1,813,869 tons in 1880.

In 1900 the number of establishments in the Middle states which were engaged in the manufacture for sale of hammered charcoal blooms and billets direct from iron ore was 1, and the number engaged in the production of hammered charcoal pig and scrap blooms, billets, and bars was 5. In 1890 there were 9 establishments engaged in the production of the former products and 10 engaged in the production of the latter products. The capital invested in active forge and bloomery establishments in 1900 was $178,699, compared with $838,470 in 1890 and $3,306,000 in 1880. The average number of wage-earners employed in 1900 was 166, against 411 in 1890 and 2,272 in 1880. These wage-earners received in wages $72,944 in 1900, $165,065 in 1890, and $744,954 in 1880. In 1900 the miscellaneous expenses amounted to $6,161 and in 1890 to $53,180. The cost of materials in 1900 was $260,982, against $771,423 in 1890 and $2,144,869 in 1880. In 1900 the value of the products was $395,952, compared with $1,008,494 in 1890 and $3,244,260 in 1880. The output in 1900 was 11,417 tons, against 26,299 tons in 1890 and 53,678 tons in 1880.

In 1900, 13 plants for the manufacture of iron and steel were being erected in the Middle states, of which 3 were being equipped for the manufacture of pig iron and 10 for the manufacture of steel or of rolled iron and steel. In 1890, 3 establishments were in course of construction (1 blast furnace and 2 rolling mills and steel works), and in 1880, 4 establishments were being erected, (2 to manufacture pig iron and 2 to manufacture steel or rolled iron and steel).

Since the close of the census year 1900 a number of new blast furnaces, rolling mills, and steel plants have been built in the Middle states, especially in Pennsylvania. Several new plants have also been erected in New Jersey. In addition, work upon a number of new plants is also under way in Pennsylvania and a large plant for the manufacture of pig iron, Bessemer steel, open-hearth steel, and finished rolled-steel products is now in course of construction in New York.

### THE SOUTHERN STATES.

The Southern states show a decrease of 12 in the number of active establishments reported for 1900 compared with 1890, and a decrease of 33 compared with 1880. The capital invested in active establishments shows an increase of $3,037,388 in 1900 compared with 1890, or 7.1 per cent. In 1900 the number of wage-earners increased 4,839 compared with 1890, or 28.4 per cent, and the wages paid $1,697,629, or 24.7 per cent. Comparisons for 1880 are omitted. The increase in miscellaneous expenses in 1900 over 1890 was $188,955, or 9 per cent. The cost of the materials used in 1900 was $14,086,199 greater than in 1890, or 52.1 per cent, and $27,394,342 greater than in 1880, or 199.4 per cent; the value of the products in 1900 exceeded by $23,789,009, or 59.5 per cent, the value reported for 1890, and by $40,765,087, or 177.2 per cent, the value reported for 1880. In volume the output of 1900 was 1,417,623 tons greater than that of 1890, or 69.1 per cent, and 2,919,363 tons greater than that of 1880, or 531.5 per cent.

The number of active blast furnace establishments in the Southern states in 1900 was 64, compared with 73 in 1890 and 59 in 1880. The amount of capital invested in 1900 was $27,010,584, compared with $29,974,471 in 1890. In the figures for the former year rented property valued at $460,500 is included, while the figures for the latter year include rented property valued at $783,000. The wage-earners employed in 1900 numbered 10,747, compared with 7,932 in 1890; the wages paid amounted to $3,193,014 in 1900 and to $2,917,158 in 1890; and the miscellaneous expenses to $1,443,414 in 1900 and to $1,578,512 in 1890. Comparisons for 1880 are not made with either 1900 or 1890. The cost of the materials used in 1900 amounted to $21,150,098, compared with $15,410,982 in 1890 and $4,452,864 in 1880. The value of products in 1900 was $33,576,226, against $22,494,870 in 1890 and $7,769,050 in 1880. The pig iron made in 1900 amounted to 2,604,510 tons, compared with 1,638,022 tons in 1890 and 312,890 tons in 1880.

The establishments which produced steel ingots or castings or rolled iron and steel in 1900 in the Southern states numbered 32, compared with 35 in 1890 and the same number in 1880. The capital invested by active establishments was $18,748,767 in 1900 (including $767,313 of rented property), $13,039,181 in 1890 (including $500,000 of rented property), and $9,675,791 in 1880. The average number of wage-earners was 11,083 in 1900, 9,059 in 1890, and 9,748 in 1880. The wages paid amounted to $5,343,560 in 1900, $3,912,027 in 1890, and $3,620,136 in 1880. The amount paid for miscellaneous expenses in 1900 aggregated $846,628 and in 1890, $530,117. Miscellaneous expenses were not reported in 1880. In 1900 the cost of the materials used was $19,917,690, compared with $11,503,000 in 1890 and $9,038,048 in 1880. The value of the products amounted to $30,068,455 in 1900, $17,312,282 in 1890, and $14,715,410 in 1880. The quantity of products reported was 860,090 tons in 1900, 408,284 tons in 1890, and 228,934 tons in 1880.

The number of establishments in the Southern states which were engaged in the manufacture for sale of hammered charcoal blooms, billets, bars, etc., from iron ore direct or from pig and scrap, was 1 in 1900, 1 in 1890, and 36 in 1880. Details for this industry can not be given for 1900 without disclosing the operations of the single establishment in operation during that year.

In 1900 there were 6 establishments for the manu-

facture of iron and steel under construction in the Southern states, of which 1 was being equipped for the manufacture of pig iron and 5 for the manufacture of steel or of rolled iron and steel. In 1890, 23 establishments were in course of construction, of which 18 were being equipped for the manufacture of pig iron and 5 for the manufacture of steel or of rolled iron and steel. In 1880 the number of establishments being erected was 3, 2 for the manufacture of pig iron and 1 for the manufacture of rolled iron and steel. A number of new rolling mills and at least one steel plant have been erected and put in operation in the Southern states since the close of the census year 1900.

### THE WESTERN STATES.

In 1900 the Western states show an increase of 14 in the active establishments reported compared with 1890, and an increase of 29 compared with 1880. The capital invested in active establishments increased $61,905,387 in 1900 compared with 1890, or 61.3 per cent. These figures include rented property valued at $1,821,091 in 1900 and $3,687,058 in 1890. The number of wage-earners increased 25,032 in 1900 compared with 1890, or 60.5 per cent, and the wages paid $15,171,013, or 65.9 per cent. No comparisons with 1880 are made for capital, wage-earners, or wages paid. The increase in miscellaneous expenses in 1900 over 1890 was $4,747,602, or 108.7 per cent. The cost of the materials used in 1900 was $70,677,897 greater than in 1890, or 77.1 per cent, and $107,810,887 greater than in 1880, or 197.5 per cent. The value of the products in 1900 exceeded by $116,563,634, or 90 per cent, the value reported for 1890, and by $167,606,730, or 213.5 per cent, the value reported for 1880. The output of 1900 was 5,203,553 tons in excess of that of 1890, or 115.1 per cent, and 7,988,515 tons in excess of that of 1880, or 460.2 per cent.

In 1900 the number of active blast furnace establishments in the Western states was 63, against 84 in 1890 and 93 in 1880. The capital invested in 1900 amounted to $39,563,589, compared with $33,986,675 in 1890. The figures for the former year include rented property valued at $1,271,200, and the figures for the latter year $2,068,058 of similar property. In 1900 the number of wage-earners employed was 10,845, compared with 7,623 in 1890. The wages paid amounted in 1900 to $6,317,412 and in 1890 to $3,715,699. The miscellaneous expenses were $2,349,652 in 1900 and $1,490,247 in 1890. Comparisons for 1880 are not made. The cost of the materials used in 1900 amounted to $40,593,470, compared with $30,938,275 in 1890 and $17,158,649 in 1880. In 1900 the value of the products amounted to $63,748,754, against $39,611,312 in 1890 and $24,684,885 in 1880. The pig iron made in 1900 amounted to 4,571,139 tons, compared with 2,393,574 tons in 1890 and 891,549 tons in 1880.

In 1900 there were 139 establishments which produced steel ingots or castings or rolled iron or steel in the Western states, compared with 104 in 1890 and 77 in 1880. The active establishments had $123,277,771 invested in 1900 (including $549,891 of rented property), $66,949,298 in 1890 (including $1,619,000 of rented property), and $22,732,243 in 1880. The average number of wage-earners was 55,564 in 1900, 33,754 in 1890, and 22,994 in 1880. They received in wages $31,873,629 in 1900, $19,304,329 in 1890, and $10,610,298 in 1880. The miscellaneous expenses amounted in 1900 to $6,764,361 and in 1890 to $2,876,164. Miscellaneous expenses were not reported in 1880. The cost of the materials used in 1900 was $121,797,781, against $60,775,079 in 1890 and $37,270,215 in 1880. The products amounted in value to $182,366,400 in 1900, $89,940,208 in 1890, and $53,623,539 in 1880. The output amounted to 5,153,251 tons in 1900, 2,127,264 tons in 1890, and 840,754 tons in 1880.

In 1880 the Western states contained 4 forges and bloomeries for the production for sale of charcoal blooms from iron ore or from pig iron. These establishments reported a capital of $258,600; 165 employees, to whom $60,000 in wages were paid; consumed materials costing $151,500; and produced blooms valued at $200,000. Since 1880 all of these works have been abandoned. No forges or bloomeries were in operation in any of the Western states in 1900 or 1890.

The number of iron and steel establishments under construction in the Western states in 1900 was 14, of which 1 was being equipped for the manufacture of pig iron and the remainder for the manufacture of steel ingots or castings or of rolled iron and steel. In 1890, 8 establishments were in course of construction, 4 of which were being equipped for the manufacture of pig iron and 4 for the manufacture of steel or of rolled iron and steel. In 1880 the number of establishments being erected was 6—3 for the manufacture of pig iron, and 3 for the manufacture of rolled products.

Since the close of the census year 1900 a number of new rolling mills and steel works have been erected in Ohio, Indiana, and Illinois, and others are under construction. Several blast furnaces are also projected.

## PART II.—THE MANUFACTURE OF PIG IRON.

Pig iron is manufactured in blast furnaces from iron ore mixed with fuel, limestone, dolomite, oyster shells, etc. In the United States the fuel used is coke alone, bituminous coal alone, coke and bituminous coal mixed, anthracite coal alone, anthracite coal and coke mixed, charcoal alone, and charcoal and coke mixed. As a rule the pig iron is classed according to the kind of fuel used, bituminous iron including all produced with bituminous fuel; that is, with coke alone, with bituminous coal alone, or with bituminous coal and coke mixed; anthracite pig iron including all made with anthracite coal alone or with anthracite coal and coke mixed; charcoal pig iron including all made with charcoal alone; and charcoal and coke pig iron including all made with charcoal and coke mixed. The pig iron is subsequently classified or graded, according to the purpose for which it is to be used, namely, Bessemer, basic, foundry, forge, etc. Complete details concerning the production of pig iron by kind of fuel used, and by grades, will be found in later tables.

The production of all kinds of pig iron in the United States during the census year 1900 (from June 1, 1899, to May 31, 1900), including spiegeleisen, ferromanganese, and castings made direct from the blast furnace, amounted to 14,452,234 gross tons, compared with 8,845,185 tons in 1890, an increase of 5,607,049 tons, or 63.4 per cent. Compared with 1880 the increase in 1900 was 11,076,322 tons, or 328.1 per cent, and compared with 1870 it was 12,619,358 tons, or 688.5 per cent. Table 16 shows the growth of the pig-iron industry in the United States from 1870 to 1900 by decades.

TABLE 16.—BLAST FURNACES: 1870 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

| | DATE OF CENSUS. | | | | PER CENT OF INCREASE. | | |
|---|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880[2] | 1870[2] | 1890 to 1900. | 1880 to 1890. | 1870 to 1880. |
| Number of establishments | 224 | 304 | 341 | 386 | [3]26.3 | [3]10.8 | [3]11.7 |
| Capital | [4]$148,226,113 | [4]$184,608,543 | $89,531,362 | $56,145,326 | 10.1 | 50.3 | 59.5 |
| Salaried officials, clerks, etc., number | 1,763 | [5]1,068 | (6) | (6) | 65.1 | ..... | ..... |
| Salaries | $2,308,420 | [5]$1,611,687 | (6) | (6) | 43.2 | ..... | ..... |
| Wage-earners, average number | 39,358 | 33,415 | 41,695 | 27,554 | 17.8 | [3]19.9 | 51.3 |
| Total wages | $18,500,462 | $14,614,458 | $12,655,428 | $12,475,250 | 26.6 | 15.5 | 1.5 |
| Men, 16 years and over | 39,261 | 33,341 | 40,503 | 26,962 | 17.8 | [3]17.7 | 50.2 |
| Wages | $18,480,649 | $14,600,658 | (6) | (6) | 26.6 | ..... | ..... |
| Women, 16 years and over | 6 | (7) | 9 | 54 | ..... | ..... | [3]83.3 |
| Wages | $1,352 | (7) | (6) | (6) | ..... | ..... | ..... |
| Children, under 16 years | 91 | 74 | 1,183 | 538 | 23.0 | [3]93.7 | 119.9 |
| Wages | $18,461 | $13,800 | (6) | (6) | 33.8 | ..... | ..... |
| Miscellaneous expenses | $7,463,234 | $6,342,675 | (7) | (7) | 17.7 | ..... | ..... |
| Cost of materials used | $131,536,424 | $110,098,615 | $58,619,742 | $45,498,017 | 19.5 | 87.8 | 28.8 |
| Value of products[8] | $206,823,202 | $145,643,153 | $89,315,569 | $69,640,498 | 42.0 | 63.1 | 28.3 |
| Tons of pig iron[9] | 14,452,234 | 8,845,185 | 3,375,912 | 1,832,876 | 63.4 | 162.0 | 84.2 |

[1] This summary includes only active establishments for 1880, 1890, and 1900; such establishments were not reported separately in 1870.
[2] For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks, page 2, Part I, Manufacturing Industries, 1890, in regard to the depreciated currency of 1870; and in regard to the inclusion of capital, employees, and wages relating to mining and other operations in the figures for 1880, see folio 745 Statistics of Manufactures, 1880.
[3] Decrease.
[4] Includes rented property valued in 1900 at $4,896,881; in 1890, at $5,061,058.
[5] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Table 71.)
[6] Not reported separately.
[7] Not reported.
[8] Includes value of miscellaneous products for which no tonnage is given.
[9] Gross ton of 2,240 pounds.

In 1900, compared with 1890, there was a decrease of 80 in the number of establishments engaged in the manufacture of pig iron. Compared with 1880 the decrease in 1900 was 117, and compared with 1870 it was 162. During the ten years from 1890 to 1900 the capital invested in these establishments increased $13,617,570; in the twenty years from 1880 to 1900 it increased $58,694,751; and in the thirty years from 1870 to 1900 it increased $92,080,787, or 164 per cent. In comparing 1900 with 1880 the inclusion of capital invested in iron ore mines, etc., in the latter year must not be overlooked.

The increase in the number of wage-earners in 1900 compared with 1890 was 5,943, and the increase in wages paid these employees was $3,886,004. As the number of wage-earners reported for 1880, as well as the amount of wages paid, includes a large number of employees engaged in mining and other operations, no comparisons can be made for 1900 or 1890 with that year.

The cost of the materials used in 1900 exceeded the cost reported for 1890 by $21,437,809, the cost reported for 1880 by $72,916,682, and the cost reported for 1870 by $86,038,407. As compared with 1870 the increase in the cost of materials in 1900 was 189.1 per cent. In 1900 the miscellaneous expenses amounted to $7,463,234, compared with $6,342,675 in 1890. Miscellaneous expenses were not reported in 1880 or 1870.

In 1900 the value of the products reported by blast furnaces exceeded the value for 1890 by $61,180,049, for 1880 by $117,507,633, and for 1870 by $137,182,704.

Compared with 1870 there was an increase in the value of blast-furnace products in 1900 of 197 per cent. The production of pig iron in 1900 exceeded the production of 1890 by 5,607,049 tons, that of 1880 by 11,076,322 tons, and that of 1870 by 12,619,358 tons. Comparing the production of 1900 with that of 1870, the increase amounted to 688.5 per cent.

Table 17 is a comparative summary, by states, of the leading statistics of the pig-iron industry for the censuses 1880 to 1900, inclusive.

TABLE 17.—BLAST FURNACES: BY STATES, 1880 TO 1900.[1]

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 1900 | 224 | [2]$148,226,113 | 1,763 | $2,308,420 | 39,358 | $18,500,462 | $7,463,234 | $131,536,424 | $206,823,202 |
| | 1890 | 304 | [2]134,608,543 | [3]1,068 | [3]1,611,687 | 33,415 | 14,614,458 | 6,342,675 | 110,093,615 | 145,643,153 |
| | 1880 | 341 | 89,531,362 | [4] | [4] | 41,695 | 12,655,428 | [5] | 58,619,742 | 89,315,569 |
| Alabama | 1900 | 19 | 11,690,184 | 148 | 237,313 | 5,034 | 1,382,017 | 788,389 | 7,610,270 | 13,487,769 |
| | 1890 | 28 | 15,778,786 | 150 | 262,396 | 3,989 | 1,521,304 | 932,227 | 6,493,884 | 10,315,691 |
| | 1880 | 7 | 2,707,196 | ..... | ..... | 1,566 | 553,713 | ..... | 575,673 | 1,405,356 |
| Connecticut | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 940,092 | 12 | 16,247 | 117 | 50,634 | 39,496 | 412,743 | 574,438 |
| | 1880 | 6 | 1,172,000 | ..... | ..... | 139 | 65,974 | ..... | 471,467 | 644,911 |
| Georgia | 1900 | 3 | 666,916 | 18 | 13,295 | 194 | 48,391 | 8,300 | 237,421 | 391,599 |
| | 1890 | 4 | 748,845 | 15 | 19,175 | 254 | 45,501 | 52,770 | 237,386 | 339,422 |
| | 1880 | 5 | 712,000 | ..... | ..... | 754 | 77,415 | ..... | 241,796 | 466,890 |
| Illinois | 1900 | 4 | 10,683,913 | 210 | 294,524 | 3,010 | 2,176,274 | 691,724 | 11,707,965 | 15,153,646 |
| | 1890 | 5 | 9,855,274 | 11 | 23,115 | 1,420 | 896,030 | 215,252 | 8,088,153 | 10,138,310 |
| | 1880 | 3 | 950,000 | ..... | ..... | 498 | 185,054 | ..... | 1,762,609 | 2,391,850 |
| Kentucky | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 4 | 826,199 | 16 | 17,038 | 262 | 88,482 | 49,655 | 461,608 | 665,763 |
| | 1880 | 9 | 2,098,035 | ..... | ..... | 1,890 | 429,988 | ..... | 801,410 | 1,248,652 |
| Maryland | 1900 | 3 | 1,388,000 | 14 | 17,148 | 659 | 302,068 | 147,634 | 2,562,412 | 3,072,746 |
| | 1890 | 5 | 3,108,222 | 9 | 7,530 | 630 | 143,812 | 23,830 | 1,316,539 | 1,632,004 |
| | 1880 | 12 | 2,197,125 | ..... | ..... | 1,443 | 339,978 | ..... | 956,806 | 1,700,339 |
| Michigan | 1900 | 7 | 2,029,713 | 44 | 64,451 | 513 | 216,030 | 131,047 | 1,404,924 | 2,327,153 |
| | 1890 | 15 | 5,259,001 | 57 | 95,312 | 675 | 321,022 | 271,067 | 2,935,233 | 3,982,278 |
| | 1880 | 13 | 2,671,386 | ..... | ..... | 2,164 | 561,870 | ..... | 2,091,224 | 3,145,062 |
| Missouri | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 1,883,470 | 27 | 37,763 | 627 | 261,203 | 73,138 | 1,247,688 | 1,716,983 |
| | 1880 | 4 | 2,450,000 | ..... | ..... | 1,185 | 227,111 | ..... | 1,685,124 | 2,275,017 |
| New Jersey | 1900 | 9 | 2,474,639 | 50 | 44,888 | 589 | 292,213 | 90,619 | 1,987,594 | 2,546,215 |
| | 1890 | 8 | 3,131,366 | 15 | 22,386 | 640 | 240,152 | 129,384 | 1,679,937 | 2,228,724 |
| | 1880 | 12 | 3,644,500 | ..... | ..... | 1,174 | 365,639 | ..... | 2,488,670 | 3,428,747 |
| New York | 1900 | 9 | 4,003,641 | 45 | 81,221 | 1,033 | 632,393 | 288,587 | 3,508,100 | 5,046,145 |
| | 1890 | 16 | 6,443,208 | 52 | 91,181 | 1,410 | 581,107 | 349,788 | 4,212,888 | 5,182,606 |
| | 1880 | 30 | 8,886,471 | ..... | ..... | 2,518 | 902,929 | ..... | 4,166,622 | 6,816,241 |
| Ohio | 1900 | 43 | 23,296,130 | 286 | 342,271 | 6,039 | 3,286,644 | 1,266,259 | 23,543,473 | 40,366,637 |
| | 1890 | 46 | 11,750,497 | 167 | 200,890 | 4,057 | 1,856,237 | 740,283 | 15,696,665 | 19,800,268 |
| | 1880 | 62 | 13,002,586 | ..... | ..... | 8,944 | 2,725,157 | ..... | 9,149,620 | 13,038,193 |
| Pennsylvania | 1900 | 77 | 74,850,426 | 609 | 786,852 | 16,075 | 8,038,016 | 3,269,022 | 64,095,277 | 101,575,487 |
| | 1890 | 116 | 59,321,570 | 355 | 561,407 | 15,612 | 7,084,308 | 2,684,671 | 57,222,481 | 75,239,203 |
| | 1880 | 137 | 41,488,294 | ..... | ..... | 13,460 | 4,752,838 | ..... | 29,675,075 | 45,573,750 |
| Tennessee | 1900 | 13 | 5,303,095 | 81 | 103,258 | 1,763 | 438,929 | 214,207 | 3,168,581 | 4,693,215 |
| | 1890 | 11 | 3,685,806 | 64 | 87,616 | 1,012 | 438,376 | 186,574 | 2,450,882 | 3,366,464 |
| | 1880 | 9 | 1,422,626 | ..... | ..... | 1,579 | 261,897 | ..... | 489,440 | 840,022 |
| Texas | 1900 | 3 | 379,215 | 14 | 9,160 | 248 | 42,661 | 8,229 | 90,439 | 172,468 |
| | [6]1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 40,000 | ..... | ..... | 140 | 27,720 | ..... | 23,580 | 36,000 |
| Virginia | 1900 | 16 | 5,027,752 | 116 | 146,764 | 1,594 | 528,567 | 160,399 | 4,374,316 | 6,505,218 |
| | 1890 | 15 | 4,156,206 | 60 | 80,207 | 1,268 | 478,105 | 273,278 | 2,820,167 | 3,925,481 |
| | 1880 | 8 | 1,391,500 | ..... | ..... | 1,221 | 255,986 | ..... | 205,548 | 440,695 |
| West Virginia | 1900 | 3 | 1,080,553 | 24 | 21,051 | 492 | 227,235 | 58,787 | 1,693,042 | 3,119,301 |
| | 1890 | 4 | 1,446,082 | 13 | 16,758 | 411 | 182,175 | 59,143 | 1,503,847 | 2,009,505 |
| | 1880 | 8 | 1,322,425 | ..... | ..... | 893 | 240,158 | ..... | 1,158,611 | 1,631,096 |
| Wisconsin | 1900 | 5 | 1,891,765 | 26 | 41,825 | 551 | 307,733 | 109,478 | 2,015,134 | 2,900,237 |
| | 1890 | 8 | 3,546,340 | 16 | 30,154 | 595 | 276,887 | 175,405 | 2,378,006 | 3,114,892 |
| | 1880 | 7 | 2,068,218 | ..... | ..... | 853 | 357,354 | ..... | 2,101,393 | 3,295,885 |
| All other states[7] | 1900 | 10 | 3,460,171 | 78 | 104,399 | 1,564 | 581,291 | 230,553 | 3,587,476 | 5,465,366 |
| | 1890 | 9 | 2,727,579 | 29 | 42,512 | 436 | 149,123 | 87,714 | 940,058 | 1,411,121 |
| | 1880 | 8 | 1,357,000 | ..... | ..... | 1,274 | 324,647 | ..... | 575,074 | 936,918 |

[1] This summary includes only active establishments.
[2] Includes rented property, valued in 1900 at $4,896,881; in 1890 at $5,061,058.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Table 71.)
[4] Not reported separately.
[5] Not reported.
[6] Included in "all other states."
[7] Includes establishments distributed as follows: 1900—Colorado, 1; Connecticut, 1; Kentucky, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; North Carolina, 2. 1890—Colorado, 1; Indiana, 2; Maine, 1; Massachusetts, 1; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1. 1880—Indiana, 3; Maine, 1; Massachusetts, 2; Oregon, 1; Vermont, 1.

In 1900 there were 23 states which had blast furnaces located within their borders, but pig iron was produced in 21 states only, the furnaces in 2 states (Washington and Oregon) being idle. In 1890 there were 24 states which produced pig iron and 1 state (Minnesota) which had an idle furnace, and in 1880 there were 22 producing states and 2 states and 1 territory in which the furnaces were idle (Minnesota, North Carolina, and Utah territory). Since 1880 the manufacture of pig iron has been entirely abandoned in Vermont, Utah, and Indiana, although the state last named was a producer in 1890. The states which have engaged in the production of pig iron since 1880 are Colorado, California, and Washington. Of these 3 states Colorado was the only one that produced pig iron in 1900, the single furnace in the state of Washington having been idle for more than ten years. California never made pig iron during a census year; a charcoal furnace was put in operation in that state in 1881, but was soon abandoned.

During the twenty years covered by the table many changes in the rank of the producing states have taken place. Pennsylvania has for many years been far in the lead of all other states as a producer of pig iron, its production in 1900 amounting in value to almost one-half of the total value reported for the whole country, compared with more than one-half in both 1890 and 1880. Ohio was second in rank in all three periods, its production amounting in value to almost one-fifth of the total reported in 1900, against a little less than one-seventh in 1890, and a little over one-seventh in 1880. Illinois was third in rank in 1900, having advanced from the fourth position in 1890. The value of its blast furnace products in 1900 amounted to over one-thirteenth of the total reported for the whole country. In 1890 their value was almost one-fourteenth, but in 1880 it was only one thirty-seventh. Alabama, which held the third rank in 1890 in value of products, dropped to the fourth place in 1900, falling behind Illinois to the extent of $1,665,877. In 1890 the difference in the value of the pig iron produced by the two states was only $177,381, Alabama, as already stated, being in the lead. In 1900 the value of Alabama's product amounted to about one-fifteenth of the total reported for the United States, compared with about one-fourteenth in 1890 and almost one-sixtieth in 1880.

With the exception of Michigan, New York, and Wisconsin, all the states for which individual figures are given in Table 17 show an increase in the value of the pig iron produced in 1900 compared with 1890. In New York and Wisconsin the decrease was very slight, amounting to $136,461 in the former state and to $214,655 in the latter. In Michigan the decrease amounted to $1,655,125. Of the three states for which details were given in 1890 but not in 1900, namely, Connecticut, Kentucky, and Missouri, one, Kentucky, shows a fair increase in the value of its pig iron output, while the other two states show quite a heavy decline, the falling off in Missouri being especially marked.

Of the states which increased the value of their pig iron production in 1900 compared with 1890, and of which mention has not already been made, Virginia deserves especial notice, its increase amounting to $2,579,737, or almost six times the value of its total pig iron output in 1880. West Virginia, Tennessee, and Maryland also show encouraging increases in the value of their output compared with ten years ago.

Taking up the number of wage-earners employed in the manufacture of pig iron in the United States during the census year 1900, it is found that 40.8 per cent of the total were at work in the single state of Pennsylvania, the wages paid amounting to 43.5 per cent of the wages reported for the whole country. Compared with 1890 the increase in wage-earners in Pennsylvania in 1900 was only 463, but the increase in wages was almost a million dollars ($953,708). During the same period the increase in the value of the pig iron produced was $26,336,284. The erection of modern furnaces, the use of rich ore, the employment of labor-saving devices, and the more general use of up-to-date machinery and methods have enabled blast furnace operators to greatly increase the output of their furnaces without materially adding to the number of their employees. Ohio shows a much greater increase than Pennsylvania in 1900 over 1890 in the number of its wage-earners; also in the amount paid to wage-earners. So, also, does Illinois, in which state the increase in the number of wage-earners amounted to 1,590 and in wages to $1,280,244. During the same period the increase in the value of the pig iron made amounted to a little over $5,000,000.

In Alabama the number of employees shows an increase in 1900 over 1890 of 1,045, and an increase in the value of products of $3,172,078. Wages, however, show a decrease of $139,287.[1] Tennessee makes practically the same showing, the number of wage-earners employed having increased to the extent of 751, while the amount paid to wage-earners in 1900 is about the same as that paid in 1890, the increase amounting to only $553. On the other hand, the increase in the value of the pig iron manufactured in this state in 1900 compared with 1890 was $1,326,751. As a rule all the states reporting an increase in the value of the pig iron made in 1900 compared with 1890 also show an increase in wages, even though the number of wage-earners employed in 1900 was less than the number at work in 1890.

[1] The amounts reported for wages in Alabama and Tennessee are incorrect, owing to misunderstanding on the part of the different companies in filling out the schedules, but it is impossible to secure the necessary data to make a correct showing in time for this report.

### CAPITAL.

Table 18 shows the number of active and idle blast furnace establishments in the United States in 1880, 1890, and 1900, the number of establishments which were being erected at the close of each of the years named, and the capital invested.

TABLE 18.—BLAST FURNACES: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 278 | [1] $159,379,033 | $86,975,379 | $72,403,654 |
| | 1890 | 400 | [1] 143,633,926 | 77,989,695 | 65,644,231 |
| | 1880 | 490 | 105,151,176 | 48,000,081 | 57,151,095 |
| Active | 1900 | 224 | 148,226,113 | 79,235,189 | 68,990,924 |
| | 1890 | 304 | 134,608,543 | 71,236,048 | 63,372,495 |
| | 1880 | 341 | 89,531,362 | 41,268,481 | 48,262,881 |
| Idle | 1900 | 49 | 10,126,445 | 6,868,615 | 3,257,830 |
| | 1890 | 73 | 6,458,865 | 4,695,150 | 1,763,715 |
| | 1880 | 142 | 14,394,883 | 6,277,150 | 8,117,733 |
| In course of construction. | 1900 | 5 | 1,026,475 | 871,575 | 154,900 |
| | 1890 | 23 | 2,566,518 | 2,058,497 | 508,021 |
| | 1880 | 7 | 1,224,931 | 454,450 | 770,481 |

[1] Includes rented property valued in 1900 at $5,092,581; in 1890, at $5,061,058.

The decrease in the total number of establishments in 1900 compared with 1890 was 122, and compared with 1880 it was 212. Compared with 1890 the increase in capital invested in 1900 was $15,745,107, or 11 per cent, while compared with 1880 it was $54,227,857, or 51.6 per cent. The capital reported for 1880 included investments in iron-ore mines, coal mines, etc., when these mines were operated by blast furnace companies.

The great decrease in the number of idle blast furnace establishments in 1900 compared with both 1890 and 1880 is noteworthy. So also is the fact that the amount invested in building establishments in 1900 was less than one-half of the investment reported for 1890, and about $200,000 less than the amount reported for 1880. Since the close of the census year, however, a number of new blast furnaces have been built, and others are now in course of construction; still others are projected.

### MONTHS IN OPERATION.

The active blast furnace establishments in the United States were in operation in 1900 on an average 10.16 months, compared with 9.23 months in 1890 and 8 months in 1880.

### MATERIALS USED.

Table 19 shows in detail the quantities and cost of all kinds of materials consumed by blast furnaces in 1880, 1890, and 1900. In 1900, the cost of the separate items of materials, iron ore, coal, coke, etc., consumed, includes only a part of the freight paid. In 1890 and in 1880 the cost reported for each material was the total cost at the point of consumption. In the total cost of materials for 1900, however, namely, $131,536,424, all freight charges are included. When these charges are not embraced in the individual cost reported for ore, coal, coke, etc., they are included in the cost of "all other materials." This will explain the large increase shown for this item in 1900 compared with the amount reported in 1890.

TABLE 19.—BLAST FURNACES: QUANTITY AND COST OF MATERIALS USED, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

| CLASSES. | DATE OF CENSUS. | | | | | | PER CENT OF INCREASE. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | | 1890 to 1900. | | 1880 to 1890. | |
| | Tons. | Cost. | Tons. | Cost. | Tons. | Cost. | Tons. | Cost. | Tons. | Cost. |
| Total | ..... | $131,536,424 | ..... | $110,098,615 | ..... | $58,619,742 | ..... | 19.5 | ..... | 87.8 |
| Domestic iron ore | 24,621,397 | 61,800,805 | 14,048,571 | 57,607,945 | 6,479,182 | 33,205,278 | 75.3 | 7.3 | 116.8 | 73.5 |
| Foreign iron ore, including manganese ore | 754,383 | 4,107,449 | 978,850 | 5,897,585 | [1] | [1] | [2] 22.5 | [2] 30.4 | ..... | ..... |
| Fluxing material | 7,326,706 | 5,059,632 | 5,021,688 | 4,196,878 | 2,829,598 | 2,547,336 | 45.9 | 20.6 | 77.5 | 64.8 |
| Anthracite coal and culm | 886,564 | 2,297,419 | 1,796,854 | 5,165,761 | 2,334,984 | 8,012,755 | [2] 50.7 | [2] 55.5 | [2] 23.0 | [2] 35.5 |
| Bituminous coal and slack | 832,235 | 1,101,312 | 491,971 | 759,522 | 939,065 | 2,095,887 | 69.2 | 45.0 | [2] 47.6 | [2] 63.8 |
| Coke | 14,697,797 | 38,976,770 | 8,248,156 | 27,435,780 | 1,900,228 | 8,129,240 | 78.2 | 42.1 | 334.1 | 237.5 |
| Charcoal | [3] 31,421,585 | 1,846,201 | [3] 67,672,156 | 4,523,320 | [3] 53,909,828 | 3,679,120 | [2] 53.6 | [2] 59.2 | 25.5 | 22.9 |
| Mill cinder and scrap, etc | 1,600,313 | 3,772,385 | 1,145,599 | 3,086,808 | 316,114 | 910,667 | 39.7 | 22.2 | 262.4 | 239.0 |
| All other materials | ..... | 12,574,451 | ..... | 1,425,016 | ..... | 39,459 | ..... | 782.4 | ..... | 3,511.4 |

[1] Domestic and foreign ore were not reported separately at the census of 1880. [2] Decrease. [3] Bushels.

The foreign ore reported above, which includes considerable quantities of manganese ore, was obtained from Cuba, Spain, Italy (island of Elba), Greece, Algeria, Russia, India, Japan, Turkey, Newfoundland, Canada, Brazil, Chile, Colombia, and perhaps one or two other countries. Cuba furnished by far the largest quantity in 1900 and 1890, about one-half of the 754,383 tons reported for 1900 coming from that country. Considerable quantities also came from Spain and Newfoundland in 1900. In 1890 almost all the foreign iron ore used came from Cuba. Large quantities of foreign manganese ores were consumed in Pittsburg in 1900,

in the manufacture of spiegeleisen and ferromanganese, and some even as far west as Chicago; aside from this, very little foreign ore was consumed by blast furnaces west of the Allegheny Mountains. Manganese ores came chiefly from Russia, India, Japan, Brazil, Cuba, Colombia, and Chile. The consumption of foreign ore in 1900 was 219,467 tons less than in 1890. In 1880 the quantity consumed was not ascertained.

In addition to the foreign and domestic ores consumed in 1900 in the manufacture of pig iron, spiegeleisen, and ferromanganese, 1,600,313 tons of waste materials from other industrial operations were also used. These materials include mill cinder and roll and hammer scale obtained from puddling furnaces, heating furnaces, and rolling mills; also residuum from the smelting of franklinite in the manufacture of zinc, and blue billy, or purple ore, the latter being a by-product of the manufacture of sulphuric acid from iron pyrites. The aggregate consumption of ore and waste materials enumerated amounted in 1900 to 26,976,093 tons. From these materials 14,452,234 tons of pig iron were made in 1900, compared with a production of 8,845,185 tons of pig iron in 1890 from 16,168,020 tons of similar materials, and with a production of 3,375,912 tons of pig iron in 1880 from 6,795,296 tons of iron ore and materials used as iron ore.

In 1890 Mr. John Birkinbine, special agent in charge of the collection of iron-ore statistics for the Eleventh Census, estimated the yield of metal in the blast furnace from foreign iron ore, mill cinder, rolling-mill scale, zinc residuum, etc., at about 57 per cent. Assuming that the yield of metal from materials of this character was about the same in 1900 as in 1890, it is found that the pig iron thus obtained amounted to about 1,342,176 tons. Deducting this quantity from the total pig iron made in 1900, namely, 14,452,234 tons, 13,110,058 tons remain as the approximate quantity produced from iron ores mined in the United States, or an average yield of metal from domestic iron ore of 53.2 per cent, compared with 54.4 per cent in 1890 and, approximately, 48.9 per cent in 1880.

In the census report for 1890 attention was called to the fact that no statistics of the consumption of foreign iron ore in this country were available for 1880. The iron ore imported in that year, namely, 371,584 tons, was assumed to have entered into consumption, and it was, therefore, deducted from the 6,479,182 tons of ore reported for 1880, thus leaving 6,107,598 tons of domestic ore for consumption. Adding the foreign ore to the 316,114 tons of mill cinder, roll and hammer scale, etc., reported, a total of 687,698 tons was reached, yielding approximately 391,988 tons of pig iron. Deducting this quantity from the 3,375,912 tons of pig iron reported for 1880, it was found that approximately 2,983,924 tons of pig iron were made from the 6,107,598 tons of domestic iron ore consumed, or an average yield of metal per ton of ore, as stated above, of 48.9 per cent.

The above figures show that the yield of metal per ton of domestic iron ore consumed was a little less in 1900 than in 1890, but was considerably greater than the approximate yield for 1880. The slight loss in the yield of metal in 1900 compared with 1890 may be explained by the fact that in late years considerable quantities of Lake Superior ore containing less than 60 per cent of metallic iron have been shipped to various furnaces, while ten years ago almost all the ore shipped from this region analyzed over 60 per cent.

### PRODUCTS.

Table 20 shows the production of pig iron in 1880, 1890, and 1900, according to the kind of fuel used, and the percentage of the total production by fuels for each of the years named. The quantity of spiegeleisen and ferromanganese made is included; also all castings made direct from the furnace.

TABLE 20.—BLAST FURNACES: PRODUCTION OF PIG IRON, INCLUDING DIRECT CASTINGS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, WITH PER CENT OF TOTAL FOR EACH CLASS, 1880 TO 1900.

| CLASSES. | TONS.[1] | | | PER CENT OF TOTAL PRODUCTION. | | |
|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880[2] | 1900 | 1890 | 1880 |
| Total | 14,452,234 | 8,845,185 | 3,375,912 | 100.0 | 100.0 | 100.0 |
| Mixed anthracite coal and coke pig iron | 1,796,000 | 1,690,394 | 638,027 | 12.4 | 19.1 | 18.9 |
| Coke and bituminous coal pig iron | 12,253,818 | 6,265,865 | 1,354,958 | 84.8 | 70.8 | 40.1 |
| Charcoal pig iron | 303,567 | 593,492 | 388,677 | 2.1 | 6.7 | 11.5 |
| Anthracite coal pig iron | 45,857 | 295,434 | 994,250 | 0.3 | 3.4 | 29.5 |
| Mixed charcoal and coke pig iron | 52,992 | ..... | ..... | 0.4 | ..... | ..... |

[1] Gross ton of 2,240 pounds.
[2] 4,229 tons of direct castings, shown in the report for blast furnaces, 1880, have been distributed among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census.

The production of pig iron with anthracite coal and coke mixed for fuel increased slightly in 1900, compared with 1890. The great increase, however, was in pig iron made with bituminous fuel; that is, with coke alone or with coke and bituminous coal mixed. A marked decline is shown in the production of charcoal pig iron in 1900, compared with 1890; also, in the production of pig iron with anthracite coal alone, the falling off in iron made with the latter fuel being especially heavy compared with both 1890 and 1880. For the first time in the census tables, pig iron made with a mixture of charcoal and coke as fuel appears.

The increase in 1900 in the production of pig iron made with coke and bituminous coal, compared with 1890, was 5,987,953 tons, or 95.6 per cent, and compared with 1880 it was 10,898,860 tons, or 804.4 per cent. In 1900, compared with 1890, the increase in the production of pig iron with mixed anthracite coal and coke amounted to only 105,606 tons, or 6.2 per cent, while compared with 1880 the increase was 1,157,973 tons, or 181.5 per cent.

The production of charcoal pig iron in 1900 fell off

289,925 tons compared with 1890, or 48.9 per cent, and compared with 1880 it declined 85,110 tons, or 21.9 per cent. The use of anthracite coal alone for fuel in the manufacture of pig iron is gradually being abandoned. Compared with 1890, the production with this fuel decreased in 1900 to the extent of 249,577 tons, or 84.5 per cent. Compared with 1880, the decrease was 948,393 tons, or 95.4 per cent. In 1900 only 2 establishments reported the manufacture of pig iron with anthracite coal alone.

During the census year 1900, 52,992 tons of pig iron were produced with a mixture of coke and charcoal as fuel. Since the close of the census year, almost all of the furnaces which used this mixture have returned to the use of unmixed fuel, either charcoal or coke, as the case may be.

Table 21 shows in detail the quantity and value of the pig iron made in the United States in 1880, 1890, and 1900, according to the kind of fuel used. Direct castings and spiegeleisen and ferromanganese are included.

TABLE 21.—BLAST FURNACES: QUANTITY AND VALUE OF PRODUCTS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

| CLASSES OF PRODUCTS. | 1900 | | 1890 | | 1880[1] | | PER CENT OF INCREASE. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Tons.[2] | Value. | Tons.[2] | Value. | Tons.[2] | Value. | 1890 to 1900. | | 1880 to 1890. | |
| | | | | | | | Tons. | Value. | Tons. | Value. |
| Total | | $206,823,202 | | $145,643,153 | | $89,315,569 | | 42.0 | | 63.1 |
| Mixed anthracite coal and coke pig iron | 1,796,000 | 26,066,003 | 1,690,394 | 28,195,996 | 638,027 | 16,627,291 | 6.2 | [3]7.6 | 164.9 | 69.6 |
| Coke and bituminous coal pig iron | 12,253,818 | 178,763,091 | 6,265,865 | 100,687,256 | 1,354,958 | 35,513,233 | 95.6 | 72.6 | 362.4 | 183.5 |
| Charcoal pig iron | 303,567 | 5,338,739 | 593,492 | 11,957,710 | 388,677 | 12,488,744 | [3]48.9 | [3]55.4 | 52.7 | [3]4.3 |
| Anthracite coal pig iron | 45,857 | 612,702 | 295,434 | 4,772,021 | 994,250 | 23,574,742 | [3]84.5 | [3]87.2 | [3]70.3 | [3]79.8 |
| Mixed charcoal and coke pig iron | 52,992 | 798,865 | | | | | | | | |
| Total tonnage and value | 14,452,234 | 206,579,400 | 8,845,185 | 145,612,983 | 3,375,912 | 88,204,010 | 63.4 | 41.9 | 162.0 | 65.1 |
| All other products | | 243,802 | | 30,170 | | 1,111,559 | | 708.1 | | [3]97.3 |

[1] 4,229 tons of direct castings, shown in the report for blast furnaces, 1880, have been distributed among the several kinds of pig iron; hence the quantities of pig iron do not agree with the data shown in the report for the Tenth Census
[2] Gross ton of 2,240 pounds.
[3] Decrease.

The production of spiegeleisen during the census year amounted to 163,672 tons (see Table 23) and the production of ferromanganese to 51,878 tons; total, 215,550 tons, valued at $5,871,955, or an average value per ton of $27.24. Spiegeleisen was made in New Jersey, Pennsylvania, Maryland, Illinois, and Colorado, and ferromanganese in New York and Pennsylvania. During 1900, three establishments—two in New Jersey and one in Pennsylvania—produced spiegeleisen only. The total production of direct castings, as shown by Table 24, amounted to 7,123 tons, valued at $87,662, or an average value per ton of $12.31. The producing establishments were located in New Jersey, Pennsylvania, Virginia, Alabama, Illinois, and Missouri. Of the total production of spiegeleisen and ferromanganese 43,213 tons, valued at $932,659, were made with mixed anthracite coal and coke, and 172,337 tons, valued at $4,939,296, were made with coke and bituminous coal. Of the total production of direct castings, 1,080 tons, valued at $20,830, were made with mixed anthracite coal and coke; 6,033 tons, valued at $66,711, with coke and bituminous coal; and 10 tons, valued at $121, with charcoal.

The value reported for other products amounted to $243,802 in 1900, of which $143,862 were received for custom work and repairing and $99,940 for miscellaneous products. The states reporting receipts for custom work and repairing were Pennsylvania, $1,754; Ohio, $29,658; and Illinois, $112,450. Those reporting products other than pig iron were New York, $3,595; New Jersey, $25,149; Pennsylvania, $17,946; Maryland, $11,876; Georgia, $5,328; Ohio, $28,221; Illinois, $7,500; and Wisconsin, $325.

Table 22 shows the production, value, and average price per ton, by states, of pig iron in 1880, 1890, and 1900, and the total number of completed furnaces (including active and idle) during the same years. The value of the direct castings and of the spiegeleisen and ferromanganese produced in each of the years named is included. The value of miscellaneous products and the amount received for custom work and repairing are not included.

TABLE 22.—BLAST FURNACES: QUANTITY, VALUE, AND AVERAGE PRICE PER TON OF ALL KINDS OF PIG IRON, BY STATES, 1880 TO 1900.

| STATES. | Year. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|---|
| United States | 1900 | 399 | [1]14,452,234 | [1]$206,579,400 | $14.29 |
| | 1890 | 559 | 8,845,185 | 145,612,983 | 16.46 |
| | 1880 | 681 | 3,375,912 | 88,204,010 | 26.13 |
| Alabama | 1900 | 45 | 1,203,277 | 13,487,769 | 11.21 |
| | 1890 | 48 | 817,508 | 10,315,691 | 12.62 |
| | 1880 | 15 | 55,657 | 1,402,156 | 25.19 |
| Connecticut | [2]1900 | | | | |
| | 1890 | 9 | 19,871 | 574,433 | 28.91 |
| | 1880 | 8 | 16,767 | 644,911 | 38.46 |
| Georgia | 1900 | 5 | 21,505 | 386,271 | 17.96 |
| | 1890 | 5 | 25,099 | 339,422 | 13.52 |
| | 1880 | 10 | 20,624 | 457,490 | 22.18 |

[1] Includes 7,123 tons of direct castings, valued at $87,662, and 215,550 tons of spiegeleisen and ferromanganese, valued at $5,871,955.
[2] Included in "all other states."

TABLE 22.—BLAST FURNACES: QUANTITY, VALUE, AND AVERAGE PRICE PER TON OF ALL KINDS OF PIG IRON, BY STATES, 1880 to 1900—Continued.

| STATES. | Year. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|---|
| Illinois | 1900 | 17 | 1,469,530 | $15,033,696 | $10.23 |
| | 1890 | 15 | 666,676 | 10,136,960 | 15.20 |
| | 1880 | 10 | 85,239 | 2,391,850 | 28.06 |
| Kentucky | [1]1900 | | | | |
| | 1890 | 6 | 39,534 | 665,763 | 16.84 |
| | 1880 | 22 | 51,882 | 1,240,152 | 23.90 |
| Maryland | 1900 | 7 | 241,172 | 3,060,870 | 12.69 |
| | 1890 | 14 | 86,282 | 1,632,004 | 18.91 |
| | 1880 | 22 | 53,271 | 1,668,164 | 31.31 |
| Michigan | 1900 | 13 | 141,377 | 2,327,153 | 16.46 |
| | 1890 | 26 | 203,417 | 3,982,278 | 19.58 |
| | 1880 | 27 | 106,774 | 3,123,245 | 29.25 |
| Missouri | [1]1900 | | | | |
| | 1890 | 8 | 90,205 | 1,716,983 | 19.03 |
| | 1880 | 17 | 84,866 | 2,196,780 | 25.89 |
| New Jersey | 1900 | 11 | 150,002 | 2,521,066 | 16.81 |
| | 1890 | 18 | 129,500 | 2,228,724 | 17.21 |
| | 1880 | 20 | 140,548 | 3,410,663 | 24.27 |
| New York | 1900 | 19 | 334,512 | 5,042,550 | 15.07 |
| | 1890 | 37 | 307,446 | 5,182,606 | 16.86 |
| | 1880 | 57 | 279,793 | 6,697,349 | 23.94 |
| Ohio | 1900 | 53 | 2,559,694 | 40,308,758 | 15.75 |
| | 1890 | 71 | 1,203,142 | 19,800,208 | 16.46 |
| | 1880 | 103 | 489,921 | 12,908,286 | 26.35 |
| Pennsylvania | 1900 | 148 | 6,778,584 | 101,555,787 | 14.98 |
| | 1890 | 221 | 4,345,986 | 75,212,758 | 17.31 |
| | 1880 | 269 | 1,723,492 | 44,940,028 | 26.08 |
| Tennessee | 1900 | 19 | 374,249 | 4,693,215 | 12.54 |
| | 1890 | 19 | 264,187 | 3,366,464 | 12.74 |
| | 1880 | 21 | 42,744 | 824,932 | 19.30 |
| Texas | 1900 | 4 | 9,789 | 172,468 | 17.62 |
| | [1]1890 | | | | |
| | 1880 | 1 | 1,250 | 36,000 | 28.80 |
| Virginia | 1900 | 26 | 428,117 | 6,505,218 | 15.20 |
| | 1890 | 31 | 278,899 | 3,925,481 | 14.08 |
| | 1880 | 31 | 15,988 | 429,695 | 26.87 |
| West Virginia | 1900 | 3 | 188,292 | 3,119,801 | 16.57 |
| | 1890 | 5 | 115,508 | 2,009,505 | 17.40 |
| | 1880 | 11 | 71,473 | 1,624,296 | 22.73 |
| Wisconsin | 1900 | 6 | 217,451 | 2,899,912 | 13.34 |
| | 1890 | 10 | 192,692 | 3,114,892 | 16.22 |
| | 1880 | 14 | 105,609 | 3,293,635 | 31.19 |
| All other states[2] | 1900 | 23 | 334,683 | 5,465,366 | 16.33 |
| | 1890 | 16 | 59,833 | 1,408,811 | 23.54 |
| | 1880 | 23 | 30,014 | 914,378 | 30.46 |

[1] Included in "all other states."
[2] Includes establishments distributed as follows: 1900—Colorado, 1; Connecticut, 1; Kentucky, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; North Carolina, 2. 1890—Colorado, 1; Indiana, 2; Maine, 1; Massachusetts, 1; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1. 1880—Indiana, 3; Maine, 1; Massachusetts, 2; Oregon, 1; Vermont, 1.

Massachusetts reports the highest average price per ton for pig iron in 1900. Connecticut reports the next highest average price. No details can be given for these states for the year named, however, without disclosing the operations of their single pig iron producing establishments. The pig iron made in both states is all produced with charcoal as fuel, and is used for special purposes. Georgia reports the next highest average price per ton for 1900, namely, $17.96. Almost all of this iron was made with charcoal as fuel. The average price reported by Pennsylvania in 1900, nearly all the iron being made with mineral fuel, was $14.98, compared with $17.31 in 1890 and $26.08 in 1880. In Ohio the average price in 1900 was $15.75, compared with $16.46 in 1890 and $26.35 in 1880.

The lowest average price for pig iron in 1900 was reported by Illinois, the average being $10.23. A large part of the pig iron made in this state is consumed by the makers in the manufacture of steel, which perhaps accounts for the low average price shown. Alabama reported the next lowest average, $11.21, and Tennessee the next, $12.54.

The average price for the whole country, as shown by the table, was $14.29 in 1900, $16.46 in 1890, and $26.13 in 1880.

Table 23 shows the production of pig iron by grades and by states for the census year 1900. Statistics of a similar character were not compiled at the census of 1890 or 1880.

Bessemer pig iron (below 0.10 per cent phosphorus) is made into steel in a Bessemer converter, the carbon and silicon being removed as gases by blowing cold air through the molten pig iron. The percentage of phosphorus and sulphur in Bessemer pig iron must be very low, as neither is removed in the conversion of the iron into steel.

Low-phosphorus iron (below 0.04 per cent phosphorus), which is included in the production of the Bessemer pig iron reported, is almost entirely used by acid open-hearth steel works in the manufacture of steel castings and special grades of plates and forgings.

Basic pig iron (below 1 per cent phosphorus) is made into steel in a basic open-hearth furnace. The silicon and sulphur should be very low.

Foundry pig iron is usually remelted in a cupola and made into castings. It contains about 93 per cent of iron, from 3 to 4 per cent of carbon, from 1.50 to 3 per cent of silicon, from 0.50 to 1 per cent of phosphorus, and from 0.20 to 1.50 per cent of manganese. The desired percentage of these ingredients varies according to the character of the castings to be made.

Forge or mill iron is used in puddling furnaces for making wrought iron. The carbon, silicon, phosphorus, and sulphur are largely removed, and the purified iron balls rolled into muck bar, this in turn being piled and rolled into finished bars.

Both white and mottled pig iron are used in puddling furnaces, and to some extent in foundry mixtures. Their chemical composition varies between wide limits.

Ferrosilicon is largely used by manufacturers of open-hearth steel castings. It usually contains from 10 to 20 per cent of silicon and is low in phosphorus.

Spiegeleisen is used chiefly by manufacturers of Bessemer steel. It contains, as a rule, from 9 to 21 per cent of manganese and is low in silicon and phosphorus.

Ferromanganese is used by Bessemer and by basic and acid open-hearth steel works. It contains from 45 to 82 per cent of manganese, although 80 per cent ferromanganese is considered the standard. It is low in silicon and phosphorus, but higher in carbon than pig iron.

At a number of furnaces it is now the practice to sell iron by analysis only, the former system of grading by fracture having been discontinued. In rendering reports for the census year all establishments of this character made careful estimates of their production by grades. The results given in Table 23 are therefore practically correct and as exact as it is possible to obtain in a general inquiry of this character.

TABLE 23.—BLAST FURNACES: GRADES OF PIG IRON, NUMBER OF ESTABLISHMENTS REPORTING, AND PRODUCTION, BY STATES, 1900.

| STATES. | Total production, tons.[1] | BESSEMER. | | BASIC. | | FOUNDRY. | | FORGE. | | WHITE AND MOTTLED, AND MISCELLANEOUS GRADES. | | FERRO-SILICON. | | SPIEGEL-EISEN. | | FERRO-MANGANESE. | | DIRECT CASTINGS. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. | Number of establishments reporting. | Tons. |
| United States | 14,452,234 | 86 | 8,475,530 | 27 | 937,439 | 154 | 3,514,743 | 102 | 1,057,616 | 99 | 208,323 | 7 | 35,910 | 11 | 163,672 | 3 | 51,878 | 24 | 7,123 |
| Alabama | 1,203,277 | | | 2 | 89,746 | 19 | 883,208 | 15 | 171,298 | 14 | 56,561 | | | | | | | 7 | 2,464 |
| Colorado | 112,843 | 1 | 109,443 | | | | | | | | | | | 1 | 3,400 | | | | |
| Connecticut | 10,457 | | | | | 1 | 10,457 | | | | | | | | | | | | |
| Georgia | 21,505 | | | | | 3 | 18,870 | 1 | 1,593 | 1 | 1,042 | | | | | | | | |
| Illinois | 1,469,530 | 3 | 1,320,287 | | | 2 | 94,008 | 1 | 7,500 | | | | | 1 | 47,688 | | | 1 | 47 |
| Kentucky | 126,566 | 1 | 21,825 | 1 | 560 | 2 | 73,407 | 1 | 20,218 | 2 | 3,856 | 1 | 6,700 | | | | | | |
| Maryland | 241,172 | 1 | 218,691 | | | 2 | 5,056 | 1 | 1,400 | 1 | 400 | | | 1 | 15,625 | | | | |
| Massachusetts | 3,030 | | | | | 1 | 3,030 | | | | | | | | | | | | |
| Michigan | 141,377 | | | | | 7 | 136,741 | | | 1 | 4,636 | | | | | | | | |
| Minnesota | 29,269 | 1 | 22,070 | 1 | 20 | 1 | 6,879 | | | 1 | 300 | | | | | | | | |
| Missouri | 40,975 | | | 2 | 13,041 | 2 | 25,881 | 1 | 2,000 | 1 | 43 | | | | | | | 1 | 10 |
| New Jersey | 150,002 | 2 | 25,575 | | | 4 | 61,840 | 4 | 34,634 | 5 | 6,079 | | | 2 | 21,824 | | | 1 | 50 |
| New York | 334,512 | | | | | 9 | 291,993 | 4 | 38,699 | 5 | 3,416 | | | | | 1 | 404 | | |
| North Carolina | 11,543 | 1 | 1,846 | | | 1 | 7,789 | 1 | 1,439 | 1 | 469 | | | | | | | | |
| Ohio | 2,559,694 | 28 | 1,862,136 | 4 | 93,700 | 20 | 305,004 | 17 | 246,487 | 9 | 33,347 | 4 | 19,020 | | | | | | |
| Pennsylvania | 6,778,584 | 41 | 4,617,969 | 13 | 666,589 | 45 | 856,472 | 35 | 446,328 | 32 | 50,077 | 2 | 10,190 | 6 | [2]75,135 | 2 | 51,474 | 12 | 4,350 |
| Tennessee | 374,249 | 1 | 11,648 | 1 | 802 | 13 | 287,655 | 8 | 54,182 | 9 | 19,962 | | | | | | | | |
| Texas | 9,789 | | | | | 3 | 6,191 | 1 | 42 | 2 | 3,556 | | | | | | | | |
| Virginia | 428,117 | | | 3 | 72,981 | 14 | 304,466 | 11 | 28,661 | 12 | 21,807 | | | | | | | 2 | 202 |
| West Virginia | 188,292 | 3 | 188,292 | | | | | | | | | | | | | | | | |
| Wisconsin | 217,451 | 3 | 75,748 | | | 5 | 135,796 | 1 | 3,135 | 3 | 2,772 | | | | | | | | |

[1] Gross ton of 2,240 pounds.

[2] Includes 355 tons of silico-spiegel.

Pennsylvania produced considerably more than one-half (54.5 per cent) of the Bessemer pig iron made in the United States in the census year 1900, over two-thirds (71.1 per cent) of the basic pig iron, almost one-fourth (24.4 per cent) of the foundry iron, over two-fifths (42.2 per cent) of the forge iron, about one-fourth (24 per cent) of the white and mottled and miscellaneous grades, over one-fourth (28.4 per cent) of the ferrosilicon, nearly one-half (45.9 per cent) of the spiegeleisen, practically all of the ferromanganese, and over three-fifths (61.1 per cent) of the direct castings.

Ohio, which ranked second in the production of Bessemer pig iron (22 per cent), second in the production of basic iron (10 per cent), and second in the production of forge iron (23.3 per cent), was first in the production of ferrosilicon (53 per cent). Its rank as a producer of foundry iron, however, was third (8.7 per cent), and it was also third as a manufacturer of white and mottled and miscellaneous grades (16 per cent).

Illinois held third rank as a manufacturer of Bessemer pig iron (15.6 per cent), and second rank (29.1 per cent) as a manufacturer of spiegeleisen. It made all told only a little over 100,000 gross tons of foundry and forge iron.

Alabama, which produced no Bessemer pig iron at all, was first in rank as a manufacturer of foundry iron (25.1 per cent), exceeding the production of this grade of iron in Pennsylvania by 26,736 tons. It ranked first in the production of white and mottled and miscellaneous grades (27.2 per cent), third in the production of basic pig iron (9.6 per cent), third in the production of forge pig iron (16.2 per cent), and second in the production of direct castings (34.6 per cent).

Twelve states produced Bessemer and low-phosphorus pig iron during the census year 1900; 8 states produced basic pig iron; 19 states produced foundry pig iron, all the active states except two (Colorado and West Virginia) reporting this grade; 15 states made forge or mill pig iron; 16 states made white and mottled and miscellaneous grades of pig iron; 3 states made ferrosilicon; 5 states made spiegeleisen; 2 states made ferromanganese; and 6 states made castings direct from the furnace.

Of the total production of all grades of pig iron in 1900, 58.6 per cent was Bessemer, 24.3 per cent was foundry, 7.3 per cent was forge, 6.5 per cent was basic, 1.4 per cent was white and mottled and miscellaneous grades, 1.1 per cent was spiegeleisen, 0.4 per

cent was ferromanganese, and 0.3 per cent was ferrosilicon. Castings made direct from the furnace amounted to only 0.1 per cent. The large number of establishments making foundry and forge iron will not escape attention. Neither will the fact that, while the number of establishments which made Bessemer pig iron was very much less than the number which made foundry pig iron, the production of the former grade was more than double the production of the latter grade. Also that the quantity of iron produced for steel-making purposes, namely, Bessemer, basic, ferrosilicon, spiegeleisen, and ferromanganese, 9,664,429 tons in all, was over seven times that produced for use in puddling furnaces, namely, forge or mill iron and white and mottled iron, which, all told, amounted to only 1,265,939 tons.

Table 24 shows the production of direct castings and spiegeleisen and ferromanganese by kind of fuel used.

TABLE 24.—BLAST FURNACES: PRODUCTION OF DIRECT CASTINGS AND SPIEGELEISEN AND FERROMANGANESE, BY KIND OF FUEL USED: 1900.

| KINDS OF FUEL USED. | TOTAL. | | DIRECT CASTINGS. | | SPIEGELEISEN AND FERROMANGANESE. | |
|---|---|---|---|---|---|---|
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| All kinds | 222,673 | $5,959,617 | 7,123 | $87,662 | 215,550 | $5,871,955 |
| Mixed anthracite coal and coke | 44,293 | 953,489 | 1,080 | 20,830 | 43,213 | 932,659 |
| Coke and bituminous coal | 178,370 | 5,006,007 | 6,033 | 66,711 | 172,337 | 4,939,296 |
| Charcoal | 10 | 121 | 10 | 121 | ..... | ..... |

[1] Gross ton of 2,240 pounds.

EQUIPMENT AND PRODUCTION.

Table 25 shows, by states, the total number of active and idle blast furnaces for 1880, 1890, and 1900; and the rank, production, and per cent of total production.

TABLE 25.—BLAST FURNACES: NUMBER OF ACTIVE AND IDLE STACKS, AND PRODUCTION, WITH PER CENT OF TOTAL PRODUCTS, STATES RANKED ACCORDING TO QUANTITY OF PRODUCT, 1880 TO 1900.

| STATES. | Year. | Completed furnace stacks. | Production of pig iron in gross tons. | Per cent of total product. | Rank. |
|---|---|---|---|---|---|
| United States | 1900 | 399 | [1]14,452,234 | 100.0 | ..... |
| | 1890 | 559 | [1]8,845,185 | 100.0 | ..... |
| | 1880 | 681 | [1]3,375,912 | 100.0 | ..... |
| Pennsylvania | 1900 | 148 | 6,778,584 | 46.9 | 1 |
| | 1890 | 221 | 4,345,986 | 49.1 | 1 |
| | 1880 | 269 | 1,723,492 | 51.1 | 1 |
| Ohio | 1900 | 53 | 2,559,694 | 17.7 | 2 |
| | 1890 | 71 | 1,203,142 | 13.6 | 2 |
| | 1880 | 103 | 489,921 | 14.5 | 2 |
| Illinois | 1900 | 17 | 1,469,530 | 10.2 | 3 |
| | 1890 | 15 | 666,676 | 7.5 | 4 |
| | 1880 | 10 | 85,239 | 2.5 | 7 |
| Alabama | 1900 | 45 | 1,203,277 | 8.3 | 4 |
| | 1890 | 48 | 817,508 | 9.2 | 3 |
| | 1880 | 15 | 55,657 | 1.6 | 10 |
| Virginia | 1900 | 26 | 428,117 | 2.9 | 5 |
| | 1890 | 31 | 278,899 | 3.2 | 6 |
| | 1880 | 31 | 15,988 | 0.5 | 17 |
| Tennessee | 1900 | 19 | 374,249 | 2.6 | 6 |
| | 1890 | 19 | 264,187 | 3.0 | 7 |
| | 1880 | 21 | 42,744 | 1.3 | 13 |
| New York | 1900 | 19 | 334,512 | 2.3 | 7 |
| | 1890 | 37 | 307,446 | 3.5 | 5 |
| | 1880 | 57 | 279,793 | 8.3 | 3 |
| Maryland | 1900 | 7 | 241,172 | 1.7 | 8 |
| | 1890 | 14 | 86,282 | 1.0 | 13 |
| | 1880 | 22 | 53,271 | 1.6 | 11 |
| Wisconsin | 1900 | 6 | 217,451 | 1.5 | 9 |
| | 1890 | 10 | 192,092 | 2.2 | 9 |
| | 1880 | 14 | 105,609 | 3.1 | 6 |
| West Virginia | 1900 | 3 | 188,292 | 1.3 | 10 |
| | 1890 | 5 | 115,508 | 1.3 | 11 |
| | 1880 | 11 | 71,473 | 2.1 | 9 |
| New Jersey | 1900 | 11 | 150,002 | 1.0 | 11 |
| | 1890 | 18 | 129,500 | 1.5 | 10 |
| | 1880 | 20 | 140,548 | 4.2 | 4 |
| Michigan | 1900 | 13 | 141,377 | 1.0 | 12 |
| | 1890 | 26 | 203,417 | 2.3 | 8 |
| | 1880 | 27 | 106,774 | 3.2 | 5 |
| Kentucky | 1900 | 6 | 126,566 | 0.9 | 13 |
| | 1890 | 6 | 39,534 | 0.5 | 14 |
| | 1880 | 22 | 51,882 | 1.5 | 12 |
| Colorado | 1900 | 2 | 112,843 | 0.8 | 14 |
| | 1890 | 2 | 11,562 | 0.1 | 18 |
| | 1880 | ..... | ..... | ..... | ..... |
| Missouri | 1900 | 2 | 40,975 | 0.3 | 15 |
| | 1890 | 8 | 90,205 | 1.0 | 12 |
| | 1880 | 17 | 84,866 | 2.5 | 8 |
| Minnesota | 1900 | 1 | 29,269 | 0.2 | 16 |
| | 1890 | 1 | ..... | ..... | ..... |
| | 1880 | 1 | ..... | ..... | ..... |
| Georgia | 1900 | 5 | 21,505 | 0.1 | 17 |
| | 1890 | 5 | 25,099 | 0.3 | 15 |
| | 1880 | 10 | 20,624 | 0.6 | 14 |
| North Carolina | 1900 | 2 | 11,543 | 0.1 | 18 |
| | 1890 | 1 | 3,015 | [2] | 24 |
| | 1880 | 7 | ..... | ..... | ..... |
| Connecticut | 1900 | 5 | 10,457 | 0.1 | 19 |
| | 1890 | 9 | 19,871 | 0.2 | 16 |
| | 1880 | 8 | 16,767 | 0.5 | 15 |
| Texas | 1900 | 4 | 9,789 | 0.1 | 20 |
| | 1890 | 3 | 7,991 | 0.1 | 19 |
| | 1880 | 1 | 1,250 | [2] | 21 |
| Massachusetts | 1900 | 3 | 3,030 | [2] | 21 |
| | 1890 | 4 | 7,482 | 0.1 | 21 |
| | 1880 | 6 | 8,521 | 0.2 | 18 |
| Oregon | 1900 | 1 | ..... | ..... | ..... |
| | 1890 | 1 | 7,510 | 0.1 | 20 |
| | 1880 | 1 | 2,857 | 0.1 | 19 |
| Washington | 1900 | 1 | ..... | ..... | ..... |
| | 1890 | 1 | 4,274 | [2] | 22 |
| | 1880 | ..... | ..... | ..... | ..... |
| Indiana | 1900 | ..... | ..... | ..... | ..... |
| | 1890 | 2 | 14,696 | 0.2 | 17 |
| | 1880 | 4 | 16,283 | 0.5 | 16 |
| Maine | 1900 | ..... | ..... | ..... | ..... |
| | 1890 | 1 | 3,303 | [2] | 23 |
| | 1880 | 1 | 1,799 | 0.1 | 20 |
| Vermont | 1900 | ..... | ..... | ..... | ..... |
| | 1890 | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 551 | [2] | 22 |
| Utah | 1900 | ..... | ..... | ..... | ..... |
| | 1890 | ..... | ..... | ..... | ..... |
| | 1880 | 2 | ..... | ..... | ..... |

[1] Includes castings made direct from furnace, as follows: 1900, 7,123 tons; 1890, 5,417 tons; 1880, 3,776 tons.
[2] Less than one-tenth of 1 per cent.

While the production of pig iron increased from 3,375,912 gross tons, in the census year 1880, to 14,452,234 tons in 1900, the number of blast furnaces decreased in the same period from 681 to 399, a loss of 282, or 41.4 per cent. This falling off was largely in New York, Pennsylvania, and Ohio, these three states losing, all told, 209 furnaces (New York 38, Pennsylvania 121, and Ohio 50). During the same period Virginia lost 5 furnaces, Tennessee 2, Maryland 15, Wisconsin 8, West Virginia 8, New Jersey 9, Michigan 14, Kentucky 16, Missouri 15, Georgia 5, North Carolina 5, Connecticut 3, and Massachusetts 3. Indiana, which had 4 furnaces in 1880 and 2 in 1890, has gone out of the pig-iron business altogether, its furnaces being last active in 1893. So, too, has Maine, which reported 1 furnace in both 1880 and 1890, no pig iron having been made in the state since the year last named. Vermont, which reported 1 furnace, and Utah which had 2 furnaces in 1880, have also given up the manufacture of pig iron, the furnace in Vermont having ceased work in 1882 and the two furnaces in Utah having gone out of blast finally in the same year.

As was explained in the report for 1890, many of the furnaces which were active in 1880 were abandoned or dismantled prior to 1890, owing to their inability to compete with the more modern, better located, and larger furnaces of that year, the abandoned stacks being, as a rule, of small capacity, and capable of producing pig iron at a profit only during periods of high prices. While the mortality among furnaces of this class was very great in the ten years from 1880 to 1890, it was still greater in the ten years from 1890 to 1900, the loss in the first period amounting to 122 furnaces, and in the latter period to 160. In both periods the actual number of abandoned or dismantled furnaces was really greater than is shown above, as the total number of furnaces reported for both 1890 and 1900 include many new stacks which were built during the two decades. Almost all of these new furnaces are favorably located for the supply of raw materials and within easy access to good markets for the sale of the pig iron produced. With the exception of perhaps a dozen charcoal furnaces but few, if any, of the furnaces which were active in 1880, and were also running in 1900, used the same machinery and were of the same height and diameter at the bosh as twenty years ago. Almost all have been rebuilt or modernized. Those which did not make improvements of this character have, as a rule, gone to the scrap pile.

But while the states named above all show more or less of a decrease in the number of active or idle furnaces reported in 1900, compared with 1880, one or two states show a strong and healthy growth during the period covered by the table. Illinois increased the number of its furnaces by 5 in 1890, compared with 1880, and by 2 in 1900 compared with 1890; Alabama shows an increase of 33 furnaces from 1880 to 1890, but a falling off of 3 furnaces from 1890 to 1900; Texas, a growth of 3 furnaces in the twenty years, 2 in the ten years from 1880 to 1890 and 1 in the ten years from 1890 to 1900; and Colorado a growth of 2 furnaces from 1880 to 1890, the number of furnaces in 1900 being the same as in 1890.

The four states of Pennsylvania, Ohio, Illinois, and Alabama produced, all told, 83.1 per cent of all the pig iron made in 1900, 79.4 per cent of the production of 1890, and 69.7 per cent of the production of 1880. Outside of these four states no other state produced over 2.9 per cent of the total production of 1900, over 3.5 per cent of the production of 1890, or over 8.3 per cent of the production of 1880.

Ranking the states according to production in 1900, Illinois advances from the fourth position in 1890 to third place in 1900, Alabama dropping to fourth place in 1900 from the third position in 1890; New York, which was fifth in rank in 1890, is now in the seventh place; Virginia, which held the sixth position in 1890, now holds the fifth rank; and Tennessee, which was seventh in 1890, is now in the sixth position; Maryland, which was thirteenth in 1890, now holds the eighth rank; Wisconsin holds the same rank that it held ten years ago, namely, the ninth; West Virginia changes places with New Jersey, the former state advancing from the eleventh position in 1890 to the tenth in 1900, and the latter state dropping from the tenth position in 1890 to the eleventh in 1900; Michigan, which held the eighth rank in 1890, is now in the twelfth position; Kentucky advances from the fourteenth rank in 1890 to the thirteenth in 1900; and Colorado from the eighteenth to the fourteenth; Missouri drops from the twelfth to the fifteenth place; Georgia from the fifteenth to the seventeenth; Connecticut from the sixteenth to the nineteenth; and Texas from the nineteenth to the twentieth. Minnesota, which was not a producer ten years ago, now holds the sixteenth rank; North Carolina advances from the twenty-fourth to the eighteenth rank; and Massachusetts holds exactly the same position as ten years ago, namely, the twenty-first. Oregon and Washington each has a charcoal furnace, but neither furnace was active in 1900, although running ten years ago. As has already been stated, Indiana, Maine, Vermont, and Utah have given up the manufacture of pig iron entirely, their 8 furnaces having all been abandoned and dismantled years ago.

Comparing 1900 with 1880, the most noticeable changes in rank are found in several of the Southern states. Alabama leaped from the tenth position in 1880 to the fourth in 1900; Virginia from the seventeenth to the fifth; and Tennessee from the thirteenth to the sixth.

On the other hand, New York dropped from the third rank in 1880 to the seventh in 1900; New Jersey from the fourth to the eleventh; Michigan from the fifth to the twelfth; Missouri from the eighth to the fifteenth; Georgia from the fourteenth to the seventeenth; and Connecticut from the fifteenth to the nineteenth.

A word or two concerning the production of pig iron per wage-earner employed in 1900 as compared with 1890 may be of interest. In 1900 the average number of wage-earners employed at blast furnaces was 39,358, and the production of all kinds of pig iron was 14,452,234 tons, while in 1890 the number of wage-earners was 33,415 and the production of pig iron 8,845,185 tons. Dividing the production of pig iron by the wage-earners gives an output per wage-earner in 1900 of 367.2 tons, and in 1890 of 264.7 tons, an increase per wage-earner of 102.5 tons.

Taking up the manufacture of pig iron by fuels, and adopting the same method as that employed above, it is found that the average production of mineral fuel pig iron per wage-earner was 376.6 tons in 1900, as compared with 274.1 tons in 1890, an increase per wage-earner of 102.5 tons. In the charcoal pig iron industry the average in 1900 was 187.04 tons per wage-earner, as compared with 179.1 tons in 1890, an increase of only 7.9 tons. In the manufacture of mixed charcoal and coke pig iron the average production per wage-earner in 1900 was 170.9 tons. As pig iron made with this fuel was not reported in the census of 1890, no comparisons with that year are possible.

Of course the figures given above relate to the industry generally. The same methods if applied to several of the leading pig-iron producing states exhibit some rather interesting results. In Illinois the average production of pig iron per wage-earner employed in 1900 was 488.2 tons, compared with 469.5 tons in 1890, an increase per wage-earner of 18.7 tons; in Ohio it was 423.9 tons in 1900, against 296.6 tons in 1890, an increase of 127.3 tons; in Pennsylvania it was 421.7 tons in 1900, against 278.4 tons in 1890, an increase of 143.3 tons; in Alabama it was 239.03 tons in 1900, against 204.9 tons in 1890, an increase of 34.1 tons; in Virginia it was 268.6 tons in 1900, against 220 tons in 1890, an increase of 48.6 tons; in New Jersey it was 254.7 tons in 1900, against 202.3 tons in 1890, an increase of 52.4 tons; in New York it was 323.8 tons in 1900, against 218 tons in 1890, an increase of 105.8 tons; and in West Virginia it was 382.7 tons in 1900, against 281 tons in 1890, an increase of 101.7 tons.

Table 26 shows by states the number of active and idle furnaces in the United States in the census year 1900.

TABLE 26.—NUMBER OF ACTIVE AND IDLE BLAST FURNACES: BY STATES, 1900.

| STATES. | NUMBER OF FURNACES. | | | | |
|---|---|---|---|---|---|
| | Aggregate. | Active. | Idle. | | |
| | | | Total. | In active establishments. | In idle establishments. |
| United States | 399 | 326 | 73 | 18 | 55 |
| Alabama | 45 | 36 | 9 | 1 | 8 |
| Colorado | 2 | 2 | | | |
| Connecticut | 5 | 1 | 4 | 1 | 3 |
| Georgia | 5 | 3 | 2 | | 2 |
| Illinois | 17 | 16 | 1 | 1 | |
| Kentucky | 6 | 5 | 1 | | 1 |
| Maryland | 7 | 6 | 1 | | 1 |
| Massachusetts | 3 | 1 | 2 | 2 | |
| Michigan | 13 | 7 | 6 | | 6 |
| Minnesota | 1 | 1 | | | |
| Missouri | 2 | 2 | | | |
| New Jersey | 11 | 10 | 1 | | 1 |
| New York | 19 | 11 | 8 | 1 | 7 |
| North Carolina | 2 | 2 | | | |
| Ohio | 53 | 50 | 3 | 1 | 2 |
| Oregon | 1 | | 1 | | 1 |
| Pennsylvania | 148 | 127 | 21 | 9 | 12 |
| Tennessee | 19 | 15 | 4 | 2 | 2 |
| Texas | 4 | 3 | 1 | | 1 |
| Virginia | 26 | 19 | 7 | | 7 |
| Washington | 1 | | 1 | | 1 |
| West Virginia | 3 | 3 | | | |
| Wisconsin | 6 | 6 | | | |

It will be observed that there were, all told, 73 furnaces which did not manufacture pig iron in the year named, 18 of which were owned by establishments which had one or more stacks in operation, and 55 by establishments which did not manufacture pig iron in any form during the twelve months covered by this report. Of the 73 idle furnaces reported, 39 used mineral fuel when in operation, 33 used charcoal, and 1 used mixed charcoal and coke.

Table 27 shows, by states, the number of active and idle blast furnaces in the United States during the census years 1880, 1890, and 1900, the kinds of fuel used by these furnaces, and their total daily capacity in gross tons, according to the kind of fuel used.

TABLE 27.—BLAST FURNACES: NUMBER AND CAPACITY OF COMPLETED STACKS, CLASSIFIED ACCORDING TO KIND OF FUEL USED, BY STATES, 1880 to 1900.

| STATES. | Year. | Total number of completed furnace stacks. | Total daily capacity in tons of 2,240 pounds. | COKE AND BITUMINOUS COAL FURNACES. | | ANTHRACITE AND MIXED ANTHRACITE AND COKE FURNACES. | | CHARCOAL FURNACES. | | MIXED CHARCOAL AND COKE FURNACES. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number of stacks. | Daily capacity in tons. | Number of stacks. | Daily capacity in tons. | Number of stacks. | Daily capacity in tons. | Number of stacks. | Daily capacity in tons. |
| United States | 1900 | 399 | 58,569 | 235 | 46,227 | 93 | 9,311 | 66 | 2,681 | 5 | 350 |
| | 1890 | 559 | 37,889 | 249 | 25,162 | 170 | 9,349 | 140 | 3,378 | ..... | ..... |
| | 1880 | 681 | 17,186 | 199 | 7,473 | 281 | 6,761 | 251 | 2,952 | ..... | ..... |
| Alabama | 1900 | 45 | 6,103 | 37 | 5,743 | ..... | ..... | 8 | 360 | ..... | ..... |
| | 1890 | 48 | 3,783 | 34 | 3,242 | ..... | ..... | 14 | 541 | ..... | ..... |
| | 1880 | 15 | 303 | 5 | 161 | ..... | ..... | 10 | 142 | ..... | ..... |
| Colorado | 1900 | 2 | 400 | 2 | 400 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 2 | 196 | 2 | 196 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Connecticut | 1900 | 5 | 75 | ..... | ..... | ..... | ..... | 5 | 75 | ..... | ..... |
| | 1890 | 9 | 115 | ..... | ..... | ..... | ..... | 9 | 115 | ..... | ..... |
| | 1880 | 8 | 81 | ..... | ..... | ..... | ..... | 8 | 81 | ..... | ..... |
| Georgia | 1900 | 5 | 300 | 2 | 185 | ..... | ..... | 3 | 115 | ..... | ..... |
| | 1890 | 5 | 231 | 2 | 156 | ..... | ..... | 3 | 75 | ..... | ..... |
| | 1880 | 10 | 129 | 2 | 67 | ..... | ..... | 8 | 62 | ..... | ..... |
| Illinois | 1900 | 17 | 4,408 | 17 | 4,408 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 15 | 2,475 | 15 | 2,475 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 10 | 538 | 10 | 538 | ..... | ..... | ..... | ..... | ..... | ..... |
| Indiana | 1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 2 | 54 | 2 | 54 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 4 | 65 | 3 | 52 | ..... | ..... | 1 | 13 | ..... | ..... |
| Kentucky | 1900 | 6 | 525 | 6 | 525 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 6 | 288 | 5 | 273 | ..... | ..... | 1 | 15 | ..... | ..... |
| | 1880 | 22 | 350 | 4 | 167 | ..... | ..... | 18 | 183 | ..... | ..... |
| Maine | 1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 1 | 16 | ..... | ..... | ..... | ..... | 1 | 16 | ..... | ..... |
| | 1880 | 1 | 16 | ..... | ..... | ..... | ..... | 1 | 16 | ..... | ..... |
| Maryland | 1900 | 7 | 1,080 | 5 | 1,030 | ..... | ..... | 2 | 50 | ..... | ..... |
| | 1890 | 14 | 637 | 4 | 470 | 3 | 67 | 7 | 100 | ..... | ..... |
| | 1880 | 22 | 251 | 4 | 51 | 5 | 99 | 13 | 101 | ..... | ..... |
| Massachusetts | 1900 | 3 | 40 | ..... | ..... | ..... | ..... | 3 | 40 | ..... | ..... |
| | 1890 | 4 | 49 | ..... | ..... | ..... | ..... | 4 | 49 | ..... | ..... |
| | 1880 | 6 | 72 | ..... | ..... | 1 | 25 | 5 | 47 | ..... | ..... |
| Michigan | 1900 | 13 | 930 | ..... | ..... | ..... | ..... | 13 | 930 | ..... | ..... |
| | 1890 | 26 | 1,086 | ..... | ..... | ..... | ..... | 26 | 1,086 | ..... | ..... |
| | 1880 | 27 | 754 | ..... | ..... | 2 | 121 | 25 | 633 | ..... | ..... |
| Minnesota | 1900 | 1 | 75 | 1 | 75 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 1 | 134 | 1 | 134 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 36 | ..... | ..... | ..... | ..... | 1 | 36 | ..... | ..... |
| Missouri | 1900 | 2 | 200 | 1 | 150 | ..... | ..... | 1 | 50 | ..... | ..... |
| | 1890 | 8 | 491 | 5 | 384 | ..... | ..... | 3 | 107 | ..... | ..... |
| | 1880 | 17 | 669 | 8 | 446 | ..... | ..... | 9 | 222 | ..... | ..... |
| New Jersey | 1900 | 11 | 817 | 1 | 55 | 10 | 762 | ..... | ..... | ..... | ..... |
| | 1890 | 18 | 827 | ..... | ..... | 18 | 827 | ..... | ..... | ..... | ..... |
| | 1880 | 20 | 617 | ..... | ..... | 20 | 617 | ..... | ..... | ..... | ..... |
| New York | 1900 | 19 | 2,580 | 4 | 850 | 13 | 1,700 | 2 | 30 | ..... | ..... |
| | 1890 | 37 | 1,883 | 4 | 616 | 24 | 1,119 | 9 | 148 | ..... | ..... |
| | 1880 | 57 | 1,477 | ..... | ..... | 42 | 1,323 | 15 | 154 | ..... | ..... |
| North Carolina | 1900 | 2 | 62 | 2 | 62 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 1 | 13 | ..... | ..... | ..... | ..... | 1 | 13 | ..... | ..... |
| | 1880 | 7 | 35 | ..... | ..... | ..... | ..... | 7 | 35 | ..... | ..... |
| Ohio | 1900 | 53 | 10,500 | 47 | 10,360 | ..... | ..... | 6 | 140 | ..... | ..... |
| | 1890 | 71 | 5,101 | 60 | 4,981 | ..... | ..... | 11 | 120 | ..... | ..... |
| | 1880 | 103 | 2,858 | 70 | 2,471 | ..... | ..... | 33 | 388 | ..... | ..... |
| Oregon | 1900 | 1 | 50 | ..... | ..... | ..... | ..... | 1 | 50 | ..... | ..... |
| | 1890 | 1 | 38 | ..... | ..... | ..... | ..... | 1 | 38 | ..... | ..... |
| | 1880 | 1 | 11 | ..... | ..... | ..... | ..... | 1 | 11 | ..... | ..... |
| Pennsylvania | 1900 | 148 | 24,070 | 70 | 17,119 | 70 | 6,849 | 8 | 102 | ..... | ..... |
| | 1890 | 221 | 17,047 | 81 | 9,551 | 125 | 7,336 | 15 | 160 | ..... | ..... |
| | 1880 | 269 | 7,580 | 75 | 2,953 | 158 | 4,411 | 36 | 216 | ..... | ..... |
| Tennessee | 1900 | 19 | 2,270 | 11 | 1,605 | ..... | ..... | 3 | 315 | 5 | 350 |
| | 1890 | 19 | 990 | 12 | 818 | ..... | ..... | 7 | 172 | ..... | ..... |
| | 1880 | 21 | 346 | 5 | 199 | ..... | ..... | 16 | 147 | ..... | ..... |
| Texas | 1900 | 4 | 175 | ..... | ..... | ..... | ..... | 4 | 175 | ..... | ..... |
| | 1890 | 3 | 116 | ..... | ..... | ..... | ..... | 3 | 116 | ..... | ..... |
| | 1880 | 1 | 9 | ..... | ..... | ..... | ..... | 1 | 9 | ..... | ..... |
| Utah | 1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 2 | 16 | ..... | ..... | ..... | ..... | 2 | 16 | ..... | ..... |
| Vermont | 1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 10 | ..... | ..... | ..... | ..... | 1 | 10 | ..... | ..... |
| Virginia | 1900 | 26 | 2,374 | 21 | 2,280 | ..... | ..... | 5 | 94 | ..... | ..... |
| | 1890 | 31 | 1,071 | 13 | 928 | ..... | ..... | 18 | 143 | ..... | ..... |
| | 1880 | 31 | 256 | 7 | 109 | ..... | ..... | 24 | 147 | ..... | ..... |
| Washington | 1900 | 1 | 35 | ..... | ..... | ..... | ..... | 1 | 35 | ..... | ..... |
| | 1890 | 1 | 27 | ..... | ..... | ..... | ..... | 1 | 27 | ..... | ..... |
| | 1880 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| West Virginia | 1900 | 3 | 750 | 3 | 750 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 469 | 5 | 469 | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 11 | 285 | 6 | 259 | ..... | ..... | 5 | 26 | ..... | ..... |
| Wisconsin | 1900 | 6 | 750 | 5 | 630 | ..... | ..... | 1 | 120 | ..... | ..... |
| | 1890 | 10 | 752 | 4 | 415 | ..... | ..... | 6 | 337 | ..... | ..... |
| | 1880 | 14 | 422 | ..... | ..... | 3 | 165 | 11 | 257 | ..... | ..... |

Of the 399 active and idle furnaces enumerated in Table 27 for the census year 1900, 235 used coke or bituminous coal when in operation, 93 used anthracite coal alone or anthracite coal and coke mixed, 66 used charcoal alone, and 5 used a mixture of charcoal and coke. One coke furnace in Georgia for a short time during the census year used coke alone, charcoal alone, and charcoal and coke mixed. In Ohio, during the same year, one charcoal furnace used coke and bituminous coal as well as charcoal alone, and another charcoal furnace in the same state used charcoal and coke mixed as well as charcoal alone.

In 1890 there were, all told, 559 active and idle furnaces in the United States, and of this number 249 used, when running, coke alone, bituminous coal alone, or bituminous coal and coke mixed; 170 used anthracite coal alone or anthracite coal and coke mixed; and 140 used charcoal alone.

In 1880 the number of coke and bituminous coal furnaces was 199, the number of anthracite and mixed anthracite and coke furnaces was 231, and the number of charcoal furnaces was 251, the total of all kinds being 681.

From these figures it will be seen that, while there has been a great shrinkage in the last twenty years in the number of furnaces using charcoal for fuel as well as in the number of furnaces using anthracite alone and mixed anthracite and coke, there has been a healthy growth in the number of furnaces which use coke or bituminous coal and coke for fuel, the decrease in the charcoal furnaces being 185, and in the anthracite and mixed anthracite and coke furnaces 138. On the other hand, the coke and bituminous furnaces increased from 199 in 1880 to 235 in 1900, a growth of 36. But while there was a heavy mortality in the total number of furnaces from 1880 to 1900, the daily capacity of the stacks in existence in 1900 was almost three and one-half times greater than those in existence in 1880, the increase amounting to 41,383 gross tons. Almost all of this increase was in furnaces using coke and bituminous coal, the total growth in the daily capacity of these furnaces in the twenty years amounting to 38,754 tons. The 93 anthracite and mixed anthracite and coke furnaces reported in 1900 show an increase in daily capacity of 2,550 tons over the 231 furnaces reported in 1880. In the charcoal industry the 251 furnaces in existence twenty years ago reported a daily capacity of 2,952 tons, while the 66 furnaces from which reports were received in 1900 had a daily capacity of 2,681 tons, or only 271 tons less than were reported by almost four times the number of stacks in 1880. These figures show very plainly the great increase that has been made in the capacity of all blast furnaces during the past two decades.

The average daily capacity of the 399 furnaces in 1900 was 146.8 tons, compared with an average daily capacity of 67.8 tons in 1890 and 25.2 tons in 1880. In 1900 the average daily capacity of the coke and bituminous furnaces was 196.7 tons, while in 1890 it was 101.1 tons and in 1880 it was 37.6 tons. For the anthracite and anthracite and coke furnaces the average daily capacity in 1900 was 100.1 tons; in 1890 it was 55 tons; and in 1880 it was 29.3 tons. In 1900 the average daily capacity of the charcoal furnaces was 40.6 tons, against 24.1 tons in 1890 and 11.8 tons in 1880. No furnaces using charcoal and coke for fuel were reported for the census years 1890 or 1880; the average daily capacity of the 5 stacks in existence in 1900 was 70 tons.

Turning to the leading pig-iron-producing states, it is found that some very high average daily capacities are reported in 1900, especially for Illinois, Pennsylvania, and Ohio.

The former state reports an average daily capacity for its 17 coke stacks of 259.3 tons, the largest average daily capacity reported by any of the pig-iron-manufacturing states. A majority of the furnaces in Illinois are of modern construction and almost all are equipped with improved blowing machinery. In addition all use the rich iron ores of the Lake Superior region and are thus enabled to obtain very large outputs. In 1890 the average daily capacity reported by the bituminous furnaces in Illinois was 165 tons, and in 1880 it was 53.8 tons. In Pennsylvania in 1900 the coke and bituminous furnaces reported an average daily capacity of 244.6 tons; in 1890 the daily capacity reported was 117.9 tons; in 1880 it was 39.4 tons. While many of the bituminous furnaces in this state are of large size and of modern construction, quite a number are of small dimensions and capable of turning out daily only about 100 or 125 tons of pig iron. These small furnaces naturally reduce the daily average bituminous capacity for the state for 1900 considerably below that reported by Illinois.

In Ohio the daily capacity of the bituminous furnaces in 1900 averaged 220.4 tons, while in 1890 the average was only 83 tons, and in 1880, 35.3 tons. The fact that the average daily capacity of the bituminous furnaces in this state approached so closely in 1900 the average reported for Pennsylvania, will perhaps surprise some pig-iron manufacturers who have not followed closely the development of blast furnaces in recent years in Ohio. Very many of its bituminous furnaces are new and of modern design. As a rule its old furnaces have recently been remodeled, enlarged, and equipped with improved blowing machinery. At Youngstown and at Mingo Junction, Ohio has 5 of the largest blast furnaces in the world, each capable of producing 200,000 tons of pig iron annually. These 5 furnaces, if running to their full capacity, could turn out yearly almost as much pig iron as could be produced by the 21 bituminous furnaces reported by Virginia and the 3 furnaces reported by West Virginia, although many of the stacks in these two states are of fair size and are equipped with modern blowing machinery.

As an illustration of the producing capacity of a modern furnace it might be well just here to call attention to the fact that in December, 1901, Furnace E of the Edgar Thomson group of the Carnegie Steel Company, at Bessemer, Pa., produced on an average 630 gross tons of pig iron daily, its output during the month named amounting to 19,554 tons. In the manufacture of this pig iron about 1,800 pounds of coke were consumed per ton of iron made. Furnace E is 90 feet 9 inches high, and has a 22-foot bosh. But great as was the production above recorded, it was recently exceeded by the No. 1 stack of the three immense furnaces at Youngstown, Ohio, operated by the National Steel Company, this furnace producing during the month of March, 1902, 19,734 gross tons of pig iron, a daily average of over 636 tons, or 6 tons per day more than the average daily production of Furnace E of the Edgar Thomson group for December, 1901. The Youngstown furnace is 106½ feet high and has a 23-foot bosh.

But even the figures given above have been exceeded for a single day's output. Late in 1901, Carrie Furnace No. 3, at Rankin, Pa., which is operated by the Carnegie Steel Company, made in twenty-four hours 790 tons of Bessemer pig iron. This was considered a phenomenal production, and until that time had never been equaled by any blast furnace in the world. The furnace is 100 by 23 feet. This record, however, which it was thought could not be surpassed, was eclipsed on December 10, 1901, by the No. 2 furnace of the National Steel Company at Youngstown, Ohio, which produced all told on that day 806 tons of Bessemer pig iron. The furnace is 106½ by 23 feet, and was completed in 1900. It was first blown in on June 7 of that year. Since the above was written it is learned that Furnace E of the Edgar Thomson group produced in a single day, in June, 1902, 901 gross tons of pig iron.

The time in which a modern furnace can be operated without relining can not very well be definitely stated. In October, 1890, Mr. James Gayley, then superintendent of the Edgar Thomson Furnaces of Carnegie Brothers & Co., Limited, at Bessemer, Pa., in a paper read before the meeting of the British Iron and Steel Institute, in New York city, said that the time was not far distant when his firm would be "able to show a record of 300,000 tons from a furnace in three years, and on a single lining." The prediction of Mr. Gayley was very shortly more than fulfilled by Furnace H of the Edgar Thomson group, which was blown in on March 13, 1894, and which was running in June, 1902, having been in operation almost continuously and on a single lining for about eight years and three months. During this time the furnace produced, all told, 1,162,937 gross tons of pig iron. It was banked on account of a shortage of coke from May 16, 1894, to June 20, 1894. The furnace is 90 by 20 feet, and was first blown on March 1, 1890. It undoubtedly holds the world's record not only for the time covered on a single lining but for the magnitude of its output of pig iron during this time as well.

Some curious changes in the use of the different fuels are shown by an examination of Table 27. Alabama in 1880 had only 5 bituminous furnaces, but in 1900 it reported 37; during the twenty years its charcoal furnaces decreased from 10 to 8. Illinois had 10 bituminous furnaces in 1880 with a daily capacity of 538 tons; in 1900 it had 17 bituminous furnaces with a daily capacity of 4,408 tons. Kentucky increased the number of its bituminous furnaces from 4 in 1880 to 6 in 1900, but during the same period it lost, all told, 18 charcoal furnaces, not a ton of charcoal pig iron being produced within its borders in 1900. Missouri had 8 bituminous furnaces in 1880 but only 1 in 1900; in 1880 it also had 9 charcoal furnaces, but in 1900 all had been abandoned except 1 stack. Maryland had 13 charcoal furnaces in 1880, but in 1900 only 2 were left; during the twenty years it gained 1 bituminous furnace but it lost 5 anthracite and mixed anthracite and coke furnaces. The daily capacity of its 4 bituminous furnaces in 1880 was 51 tons, while the daily capacity of its 5 bituminous furnaces in 1900 was 1,030 tons.

Michigan, the leading charcoal pig iron manufacturing state, lost 12 charcoal and 2 anthracite and anthracite coal and coke mixed furnaces from 1880 to 1900, but the daily capacity of the 13 remaining charcoal furnaces in 1900 was much greater than the capacity reported by its 25 charcoal stacks in 1880. The mortality among the charcoal furnaces in this state was very heavy from 1890 to 1900, the decrease in the ten years amounting to 13, or 50 per cent. New Jersey shows a loss of 10 anthracite and mixed anthracite and coke furnaces from 1880 to 1900. In New York the decrease from 1880 to 1900 in the number of furnaces using anthracite or anthracite and coke was 29, and in charcoal it was 13. The capacity in 1900 of the remaining 13 anthracite and anthracite and coke furnaces was, however, very much greater than that reported by the 42 furnaces using this fuel in 1880. Ohio reports a very heavy decrease in furnaces in the twenty years under review, the number of its charcoal stacks dropping from 33 in 1880 to 6 in 1900, a loss of 27, while during the same period its bituminous furnaces dropped from 70 to 47, a loss of 23. The total loss in the twenty years was exactly 50 stacks. The increase in capacity during this period, however, was 267 per cent, or from 2,859 tons daily to 10,500 tons daily.

Pennsylvania also shows some curious changes. During the twenty years this state lost, all told, 121 furnaces, the decrease being greatest among its anthracite and mixed anthracite and coke furnaces, which fell from 158 in 1880 to 70 in 1900. The daily capacity of the 70 furnaces in 1900 was 2,438 tons more than that reported in 1880. Its bituminous furnaces fell from 75 in 1880 to 70 in 1900, a decrease of 5, but during the same period the daily capacity of the remaining furnaces advanced from

2,953 tons in 1880 to 17,119 tons in 1900, an increase of 14,166 tons. Compared with twenty years ago, Pennsylvania lost 28 charcoal furnaces, the number reported for 1900 being only 8. Tennessee exhibits an encouraging growth in its bituminous industry, the gain from 1880 to 1900 amounting to 6 furnaces. It lost 13 charcoal stacks, however, during this period, 5 furnaces which formerly used this fuel having changed to mixed charcoal and coke. Since the close of the census year a majority of these furnaces have again changed their fuel and are now using coke alone. Virginia, which formerly produced considerable quantities of charcoal pig iron, had in 1900 only 5 furnaces of this character, almost all of which were idle. In 1880 it had 24 charcoal furnaces, of which at least 7 were running. Its bituminous industry shows a very decided growth, the number of furnaces having advanced from 7 in 1880 to 21 in 1900.

### PIG IRON EXPORTED.

The pig iron exported by blast-furnace establishments in 1900 amounted to 166,625 tons, valued at $1,865,484, or an average value per ton of $11.19. Ten states, namely, Alabama, New York, New Jersey, Wisconsin, Ohio, Michigan, Virginia, Pennsylvania, Minnesota, and North Carolina, in the order named, reported having exported in 1900 a part of their production. The exports from Alabama amounted to 113,185 tons, valued at $1,090,620, or $9.64 per ton; from New York, 17,156 tons, valued at $246,587, or $14.37 per ton; from New Jersey, 12,000 tons, valued at $214,000, or $17.83 per ton; from Wisconsin, 9,676 tons, valued at $107,376, or $11.10 per ton; from Ohio, 8,055 tons, valued at $92,096, or $11.43 per ton; from Michigan, 3,088 tons, valued at $67,110, or $21.73 per ton; from Virginia, 2,027 tons, valued at $29,157, or $14.38 per ton; from Pennsylvania, 1,298 tons, valued at $15,798, or $12.17 per ton; from Minnesota, 100 tons, valued at $2,200, or $22 per ton; and from North Carolina, 40 tons, valued at $540, or $13.50 per ton. In the figures given above, the exports of pig iron by commission houses, etc., are not included.

### POWER.

The active blast furnace establishments in 1900 were equipped with 1,294 steam engines, with an aggregate of 494,798 horsepower; 8 gas or gasoline engines, with 122 horsepower; 14 water wheels, with 582 horsepower; 227 electric motors, with 8,693 horsepower; and 55 miscellaneous appliances, with 1,770 horsepower: a total of 505,965 horsepower of all kinds. In addition, one penal establishment in Texas reported 7 steam engines, with 590 horsepower.

The use of waterpower was reported by 1 active establishment in Connecticut, 1 in New Jersey, 5 in Pennsylvania, 1 in Virginia, and 1 in Michigan. It was also reported by 3 idle establishments in Connecticut, 1 in New York, and 2 in Pennsylvania.

The idle blast-furnace establishments reported 102 steam engines with 25,433 horsepower, and 8 water wheels with 323 horsepower: total, 25,756 horsepower.

### THE MANUFACTURE OF PIG IRON WITH MINERAL FUEL.

As has been stated heretofore, the rapid growth of the pig-iron industry in the United States during the past twenty years has been due almost entirely to the increased use of coke as a blast-furnace fuel. In 1880, when the total production of all kinds of pig iron amounted to 3,375,912 tons, almost one-half of the quantity made in the whole country was produced with anthracite coal alone or with anthracite coal and coke mixed, the production with this fuel amounting to 1,632,277 tons. In the same year, with coke alone or with bituminous coal and coke mixed, the production was 1,354,958 tons, or 277,319 tons less than the combined output with anthracite alone and with anthracite coal and coke. In 1890 the use of anthracite coal alone as a fuel had greatly declined, while the use of anthracite coal and coke had increased considerably, the combined production of pig iron with these two mineral fuels amounting to 1,985,828 tons. The production of pig iron with bituminous fuel, however, in the year named showed a phenomenal growth as compared with 1880, the output amounting to 6,265,865 tons, the difference in tonnage between the two classes of pig iron being 4,280,037 tons.

In 1900 the use of anthracite coal alone in blast furnaces had almost entirely ceased, the total production of pig iron with this fuel amounting to only 45,857 tons. The use of anthracite coal and coke mixed increased but slightly as compared with ten years ago, the pig iron produced with this fuel in 1900 exceeding the production of 1890 by only 105,606 tons. The use of bituminous fuel, however, again showed a wonderful growth, the production of 1900 exceeding that of 1890 by 5,987,953 tons, or 95.6 per cent. Comparing the combined production of anthracite and mixed anthracite and coke pig iron in 1900 with the production of bituminous pig iron alone in that year, it is found that the latter exceeded the former by 10,411,961 tons. When it is recalled that only twenty years ago the production of pig iron with anthracite coal and with anthracite and coke mixed exceeded the production of bituminous iron by 277,319 tons, the growth of this branch of the pig-iron industry becomes more apparent.

Table 28 shows the leading statistics of the manufacture of pig iron in the United States with mineral fuel during the census years 1880, 1890, and 1900.

TABLE 28.—BLAST FURNACES, MINERAL-FUEL: COMPARATIVE SUMMARY, 1880 TO 1900.[1]

| | DATE OF CENSUS. | | |
|---|---|---|---|
| | 1900 | 1890 | 1880 |
| Number of establishments | 188 | 221 | 225 |
| Capital | [2]$140,703,112 | [2]$116,982,231 | $70,262,615 |
| Salaried officials, clerks, etc., number | 1,580 | [3]809 | [4] |
| Salaries | $2,104,170 | [3]$1,258,596 | [4] |
| Wage-earners, average number | 37,425 | 30,148 | 25,025 |
| Total wages | $17,849,770 | $13,418,450 | $8,554,152 |
| Men, 16 years and over | 37,338 | 30,083 | [4] |
| Wages | $17,830,986 | $13,406,085 | [4] |
| Women, 16 years and over | 6 | ..... | [4] |
| Wages | $1,352 | ..... | [4] |
| Children, under 16 years | 81 | 65 | [4] |
| Wages | $17,432 | $12,365 | [4] |
| Miscellaneous expenses | $7,181,322 | $5,330,720 | [5] |
| Cost of materials used | $127,706,216 | $101,719,465 | $51,254,711 |
| Value of products | $200,676,934 | $133,685,378 | $76,739,573 |
| Tons of pig iron[6] | 14,095,675 | 8,251,693 | 2,987,235 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $4,623,081; in 1890, at $4,807,470.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary.
[4] Not reported separately.
[5] Not reported.
[6] Gross ton of 2,240 pounds.

Compared with 1890 there was a decrease in 1900 of 33 in the number of establishments engaged in the manufacture of pig iron with mineral fuel, and compared with 1880 there was a decrease of 37. On the other hand the capital invested by establishments which manufactured mineral-fuel pig iron in 1900 exceeded the investment of 1890 by $23,720,881. The increase in wage-earners during the same period was 7,277 and in wages it was $4,431,320. Miscellaneous expenses increased $1,850,602 in 1900 compared with 1890; the cost of materials increased $25,986,751 compared with 1890, and $76,451,505 compared with 1880; and the value of products increased $66,991,556 compared with 1890, and $123,937,361 compared with 1880. Production increased 5,843,982 tons compared with 1890, and 11,108,440 tons compared with 1880. For reasons already stated, no comparisons for either 1900 or 1890 are made with 1880 for capital invested, persons employed, or wages paid.

Table 29 is a comparative summary, by states, of the leading statistics for 1880, 1890, and 1900, of establishments engaged in the manufacture of pig iron with mineral fuel.

TABLE 29.—BLAST FURNACES, MINERAL FUEL: BY STATES, 1880 TO 1900.[1]

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 1900 | 188 | [2]$140,703,112 | 1,580 | $2,104,170 | 37,425 | $17,849,770 | $7,181,322 | $127,706,216 | $200,676,934 |
| | 1890 | 221 | [2]116,982,231 | [3]809 | [3]1,258,596 | 30,148 | 13,418,450 | 5,330,720 | 101,719,465 | 133,685,378 |
| | 1880 | 225 | 70,262,615 | [4] | [4] | 25,025 | 8,554,152 | [5] | 51,254,711 | 76,739,573 |
| Alabama | 1900 | 15 | 10,512,495 | 123 | 203,564 | 4,804 | 1,306,929 | 758,119 | 7,110,092 | 12,645,970 |
| | 1890 | 17 | 12,466,870 | 103 | 183,874 | 3,364 | 1,305,835 | [4] | 5,194,859 | 8,390,604 |
| | 1880 | 2 | 955,800 | ..... | ..... | 300 | 60,257 | ..... | 233,353 | 554,162 |
| Illinois | 1900 | 4 | 10,683,913 | 210 | 294,524 | 3,010 | 2,176,274 | 691,724 | 11,707,965 | 15,153,646 |
| | 1890 | 5 | 9,855,274 | 11 | 23,115 | 1,420 | 896,080 | [4] | 8,088,153 | 10,138,310 |
| | 1880 | 3 | 950,000 | ..... | ..... | 498 | 185,054 | ..... | 1,762,609 | 2,391,850 |
| Missouri | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 3 | 1,262,475 | 10 | 16,343 | 383 | 156,020 | [4] | 900,319 | 1,191,502 |
| | 1880 | 2 | 2,050,000 | ..... | ..... | 479 | 169,111 | ..... | 1,410,124 | 1,765,017 |
| New Jersey | 1900 | 9 | 2,474,639 | 50 | 44,888 | 589 | 292,213 | 90,619 | 1,987,594 | 2,546,215 |
| | 1890 | 8 | 3,131,366 | 15 | 22,386 | 640 | 240,152 | [4] | 1,679,937 | 2,228,724 |
| | 1880 | 12 | 3,644,500 | ..... | ..... | 1,174 | 365,639 | ..... | 2,488,670 | 3,428,747 |
| New York | 1900 | 7 | 3,781,141 | 41 | 77,549 | 998 | 620,983 | 283,351 | 3,371,684 | 4,860,154 |
| | 1890 | 13 | 5,850,119 | 47 | 84,381 | 1,338 | 550,018 | [4] | 3,964,464 | 4,850,543 |
| | 1880 | 22 | 8,059,384 | ..... | ..... | 2,050 | 762,210 | ..... | 3,712,160 | 6,009,097 |
| Ohio | 1900 | 39 | 22,823,130 | 266 | 333,281 | 5,882 | 3,257,644 | 1,242,779 | 23,438,764 | 40,191,687 |
| | 1890 | 37 | 10,985,403 | 138 | 176,115 | 3,801 | 1,795,576 | [4] | 15,387,430 | 19,355,162 |
| | 1880 | 45 | 10,022,586 | ..... | ..... | 5,514 | 1,752,741 | ..... | 8,233,013 | 11,646,754 |
| Pennsylvania | 1900 | 74 | 74,675,948 | 604 | 780,412 | 15,999 | 8,015,784 | 3,263,669 | 64,016,952 | 101,455,104 |
| | 1890 | 105 | 68,494,262 | 341 | 545,070 | 15,411 | 7,047,156 | [4] | 56,922,660 | 74,837,756 |
| | 1880 | 116 | 39,048,294 | ..... | ..... | 11,975 | 4,368,562 | ..... | 29,087,348 | 44,385,123 |
| Tennessee | 1900 | 8 | 3,906,879 | 53 | 73,206 | 1,484 | 347,907 | 191,324 | 2,564,970 | 3,856,913 |
| | 1890 | 7 | 2,827,085 | 44 | 60,106 | 811 | 357,883 | [4] | 2,018,044 | 2,702,548 |
| | 1880 | 3 | 810,626 | ..... | ..... | 623 | 145,867 | ..... | 393,685 | 640,957 |
| Virginia | 1900 | 15 | 4,958,992 | 115 | 144,654 | 1,575 | 523,367 | 158,768 | 4,352,605 | 6,459,970 |
| | 1890 | 10 | 3,874,606 | 49 | 71,177 | 1,167 | 456,001 | [4] | 2,720,195 | 3,755,651 |
| | 1880 | 1 | 500,000 | ..... | ..... | 200 | 94,781 | ..... | 76,179 | 178,920 |
| West Virginia | 1900 | 3 | 1,080,553 | 24 | 21,051 | 492 | 227,235 | 58,787 | 1,693,042 | 3,119,301 |
| | 1890 | 4 | 1,446,082 | 13 | 16,758 | 411 | 182,175 | [4] | 1,503,847 | 2,009,505 |
| | 1880 | 6 | 1,254,425 | ..... | ..... | 608 | 211,484 | ..... | 1,131,176 | 1,583,896 |
| Wisconsin | 1900 | 4 | 1,361,096 | 19 | 29,485 | 469 | 259,131 | 96,355 | 1,667,762 | 2,369,687 |
| | 1890 | 3 | 2,284,509 | 8 | 12,294 | 328 | 147,154 | [4] | 1,294,123 | 1,620,117 |
| | 1880 | 1 | 600,000 | ..... | ..... | 285 | 115,587 | ..... | 1,198,670 | 1,688,655 |
| All other states[7] | 1900 | 10 | 4,444,326 | 75 | 101,556 | 2,123 | 822,303 | 350,827 | 5,794,786 | 8,018,287 |
| | 1890 | 9 | 4,504,180 | 30 | 46,977 | 1,074 | 284,450 | [4] | 2,045,434 | 2,604,957 |
| | 1880 | 12 | 2,367,000 | ..... | ..... | 1,369 | 322,909 | ..... | 1,527,724 | 2,466,395 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $4,623,081; in 1890, at $4,807,470.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary.
[4] Not reported separately.
[5] Not reported.
[6] Included in "all other states."
[7] Includes establishments distributed as follows: 1900—Colorado, 1; Georgia, 1; Kentucky, 2; Maryland, 2; Minnesota, 1; Missouri, 1; North Carolina, 2. 1890—Colorado, 1; Georgia, 2; Indiana, 2; Kentucky, 2; Maryland, 2. 1880—Georgia, 2; Indiana, 2; Kentucky, 3; Maryland, 4; Massachusetts, 1.

There were 17 states in 1900 which produced pig iron with mineral fuel, compared with 16 states in 1890 and 16 in 1880. All the states for which details are given individually, show an increase in 1900 in the value of the pig iron produced compared with 1880, except New York and New Jersey, the former state showing a decrease of $1,148,943, and the latter state a decrease of $882,532. Compared with 1890 New York slightly increased the value of its output of mineral-fuel pig iron in 1900, the increase amounting, however, to only $9,611. During the same period New Jersey also shows a recovery in the value of its production of this kind of pig iron, the increase being $317,491. Since the close of the census year, New Jersey has completed one large blast furnace, and is now erecting an additional stack. These two furnaces will have a combined annual capacity of 260,000 gross tons. New York is now building or will shortly build six large furnaces, which, when completed, will have an annual capacity of about 1,000,000 tons. All of these furnaces will use coke for fuel. Two furnaces will be completed in 1902, two possibly in 1903, and two possibly in 1904. A large plant for the manufacture of coke will be operated in connection with the furnaces.

With the exception of Alabama, Ohio, and Illinois, none of the states for which details are given in the table show an increase in 1900 over 1890 of more than 1,000 in the number of wage-earners, although, as a rule, increases in wages are reported even when the number of wage-earners is less than ten years ago. In one or two instances, however, this is not the case.

The increase in wage-earners reported for Alabama in 1900, compared with 1890, was 1,440; in Ohio, 2,081; and in Illinois, 1,590. Very fair increases were also reported by Tennessee and Virginia. The increase in the number of wage-earners in Pennsylvania amounted to only 588, but in wages the increase was $968,628. While New York and New Jersey each show a decrease in the number of wage-earners in 1900 compared with 1890, both states reported a considerable increase in the total amount paid as wages, the increase in New York amounting to $70,965, and in New Jersey to $52,061.

The total value of the pig iron and other products reported by all blast furnaces in 1900 amounted to $206,823,202. To this total the mineral-fuel furnaces contributed $200,676,934, or 97 per cent. In 1890 the grand total was $145,643,153, to which the mineral-fuel furnaces contributed $133,685,378, or 91.8 per cent; and in 1880 it was $89,315,569, the contribution of the mineral-fuel furnaces being $76,739,573, or 85.9 per cent. These figures are significant.

Over four-fifths of the total value of the mineral-fuel pig iron produced in this country during the census year 1900 was reported by Pennsylvania, Ohio, Illinois, and Alabama, in the order named. The production in Pennsylvania amounted in value to over one-half of the total value reported for the United States, in Ohio to about one-fifth, and in Illinois and Alabama combined to almost one-seventh. In 1890 the production of Pennsylvania amounted in value to considerably over one-half of the total value reported for the country at large, that of Ohio to over one-seventh, and that of Illinois and Alabama combined to about one-seventh. In 1880 the proportion of Pennsylvania was over one-half, and that of Ohio between one-sixth and one-seventh, but the combined production of Illinois and Alabama amounted to less than 4 per cent of the total value reported for the whole country.

Tennessee and Virginia each show increases in the value of the mineral-fuel pig iron produced in 1900 compared with 1890 and 1880, but especially as compared with 1880, the output of Virginia increasing in value in 1900 to the amount of $2,704,319 compared with 1890 and $6,281,050 compared with 1880, while Tennessee increased $1,154,365 compared with 1890 and $3,215,956 as compared with 1880.

### CAPITAL.

Table 30 shows the capital invested by active and idle establishments owning or operating mineral-fuel blast furnaces in the census years 1900, 1890, and 1880; also the capital invested by establishments which, at the close of each of the years named, were erecting furnaces for the manufacture of mineral-fuel pig iron.

TABLE 30.—BLAST FURNACES, MINERAL FUEL: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 211 | [1]$147,477,827 | $81,765,862 | $65,711,965 |
| | 1890 | 277 | [1]123,697,460 | 68,946,063 | 54,751,397 |
| | 1880 | 275 | 77,161,257 | 40,933,422 | 36,227,835 |
| Active | 1900 | 188 | 140,703,112 | 76,415,782 | 64,287,330 |
| | 1890 | 221 | 116,982,231 | 63,798,965 | 53,183,266 |
| | 1880 | 225 | 70,262,615 | 36,605,322 | 33,657,293 |
| Idle | 1900 | 19 | 5,852,940 | 4,573,555 | 1,279,385 |
| | 1890 | 40 | 4,411,010 | 3,304,000 | 1,107,010 |
| | 1880 | 46 | 5,833,083 | 3,898,650 | 1,934,433 |
| In course of construction | 1900 | 4 | 921,775 | 776,575 | 145,200 |
| | 1890 | 16 | 2,304,219 | 1,843,098 | 461,121 |
| | 1880 | 4 | 1,065,559 | 429,450 | 636,109 |

[1] Includes rented property valued in 1900 at $4,768,081; in 1890 at $4,807,470.

Of the total capital invested in the blast-furnace industry during the census year 1900, namely, $159,379,033, $147,477,827, or 92.5 per cent, was invested in establishments which were prepared or were preparing

to make pig iron with mineral fuel. In 1890 the percentage was 86.1. The increase in 1900 over 1890 in the capital invested in active, idle, and building mineral-fuel establishments was $23,780,367. As has heretofore been explained, comparisons with 1880 would be misleading.

In 1900 the mineral-fuel establishments were in operation on an average 10.4 months. Comparative figures for 1890 and 1880 are not available.

MATERIALS USED.

Table 31 shows in detail the quantity and cost of the various materials consumed by the mineral-fuel blast furnaces in the manufacture of pig iron in 1880, 1890, and 1900. For reasons already given, no comparisons of the individual cost at the furnaces of iron ore, coal, coke, etc., in 1900 can be made with the cost reported for these materials for 1890 and 1880.

TABLE 31.—BLAST FURNACES, MINERAL FUEL: QUANTITY AND COST OF MATERIALS USED, 1880 TO 1900.

| CLASSES. | DATE OF CENSUS. | | | | | |
|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | |
| | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. |
| Total | | $127,706,216 | | $101,719,465 | | $51,254,711 |
| Domestic iron ore | 23,916,749 | 60,595,698 | 12,886,878 | 54,006,644 | [2] 5,642,529 | [2] 29,689,649 |
| Foreign iron ore | 754,388 | 4,107,449 | 965,741 | 5,860,349 | | |
| Fluxing material | 7,223,136 | 4,980,465 | 4,885,153 | 4,038,709 | 2,727,216 | 2,446,767 |
| Anthracite coal and culm | 886,564 | 2,297,419 | 1,796,854 | 5,165,761 | 2,334,984 | 8,012,755 |
| Bituminous coal and slack | 831,429 | 1,099,810 | 491,971 | 759,522 | 939,065 | 2,095,887 |
| Coke | 14,639,692 | 38,774,819 | 8,248,156 | 27,435,780 | 1,900,228 | 8,129,240 |
| Mill cinder, scrap, etc. | 1,599,364 | 3,769,161 | 1,144,974 | 3,084,391 | 302,186 | 841,451 |
| All other materials | | 12,081,395 | | 1,368,309 | | 38,962 |

[1] Gross ton of 2,240 pounds.

[2] Includes foreign iron ore, which was not reported separately in 1880.

During the census year 1900 the direct labor cost of producing a ton of bituminous pig iron, at furnaces where the best practice prevailed, was perhaps 12 or 13 per cent of its total cost; in 1890 it was about 15 per cent. Direct labor cost would naturally include only the labor employed at the furnace proper, and would not include the vast army of wage-earners who are given employment by the blast-furnace industry in supplying it with iron ore, coal, coke, limestone, etc.; nor would it take into consideration the thousands who are given work in transporting these materials from the mines, ovens, and quarries to the point of consumption. If the wages paid to this class of labor were included it would be found that fully 80 per cent of the total cost of making a ton of pig iron is regularly paid to the wage-earners of the country. Of course, the total labor cost varies in different sections, the richness of the ores, the equipment of the furnaces, the distance from which supplies of ore, fuel, etc., are transported being important factors.

At many of the furnaces in the South, for instance, ore, fuel, limestone, etc., are found in close proximity to the furnace, and the transportation charges are therefore very light. But the ores of this section are not so rich as those of the Lake Superior region, which are largely used by furnaces located in the Middle and Western states, and much larger quantities of coke are therefore consumed in their reduction. As a consequence, the direct labor cost per ton of iron made in the Southern states is much higher, as a rule, than the direct labor cost at Northern or Western furnaces. The rate of wages paid to furnace hands is higher in the North and West than in the South, but this is, to a certain extent, offset by the larger output of the Northern furnaces and by the more general use of labor-saving appliances, the production of pig iron per employee in 1900 at some of the furnaces located in Northern and Western states being twice that reported by a number of the furnaces located in the Southern states.

In 1900, compared with 1890, there was an increase of 11,029,871 tons in the consumption of domestic iron ore and a decrease of 211,358 tons in the consumption of foreign iron ore. The increase in the fluxing material consumed was 2,337,983 tons in 1900 over 1890 and 4,495,920 tons over 1880. Anthracite coal decreased in consumption 910,290 tons in 1900 compared with 1890, and 1,448,420 tons compared with 1880. The consumption of bituminous coal increased 339,458 tons in 1900 compared with 1890, but decreased 107,636 tons compared with 1880. In coke the increase in consumption in 1900 was 6,391,536 tons compared with 1890, and 12,739,464 tons compared with 1880. In 1900 the consumption of mill cinder and scrap was only 454,390 tons in excess of the consumption of 1890, but compared with 1880 it was 1,297,228 tons greater.

The consumption of foreign and domestic iron ore and mill cinder and scrap in 1900 in producing a ton of mineral-fuel pig iron was 4,175 pounds, compared with 4,072 pounds in 1890 and 4,458 pounds, in 1880. The fluxing material (limestone, dolomite, oyster shells, etc.) consumed per ton of iron made amounted to 1,147 pounds in 1900, compared with 1,326 pounds in 1890 and 2,045 pounds in 1880. Of anthracite coal, bituminous coal, and coke, the consumption amounted, in 1900, to 2,598 pounds per ton of pig iron made, against 2,860 pounds in 1890 and 3,880 pounds in 1880.

In 1900 in producing a ton of pig iron with anthracite coal alone the consumption of domestic and foreign iron ore and of mill cinder and scrap was 4,367 pounds, of fluxing material 1,788 pounds, and of anthracite coal 3,225 pounds. In producing a ton of pig iron with anthracite coal and coke mixed, the ore and mill cinder consumed amounted to 4,069 pounds, the fluxing material to 1,453 pounds, the anthracite coal to 1,069 pounds, and the coke to 1,997 pounds. In producing a ton of pig iron with bituminous fuel the ore, mill cinder, and scrap used amounted to 4,184 pounds, the fluxing material to 1,102 pounds, and the bituminous fuel to 2,595 pounds. Comparative figures for 1890 and 1880 are not available. In the fuel consumption given above the quantity consumed for steam raising and other purposes is, of course, included.

Taking up the iron ore, fluxing material, and fuel consumed in Pennsylvania in manufacturing a ton of bituminous pig iron in 1900, it is found that 4,122 pounds of ore, mill cinder, and scrap were so used, 1,031 pounds of fluxing material, and 2,423 pounds of bituminous fuel. In Ohio the ore, etc., used was 3,929 pounds, the fluxing material 1,097 pounds, and the bituminous fuel 2,510 pounds; in Illinois it was 4,013 pounds of ore, etc., 874 pounds of fluxing material, and 2,198 pounds of bituminous fuel; and in Alabama it was 5,268 pounds of ore, etc., 1,298 pounds of fluxing material, and 3,719 pounds of bituminous fuel. The other pig-iron producing states show wide differences in the consumption of these materials, the quantity reported by states using the rich ores of the Lake Superior region being much less than the quantity reported by states using leaner local ores.

Attention was called in the census report for 1890 to the general substitution of coke for bituminous coal as a blast-furnace fuel, the latter in 1880 having been very largely used, either alone or as a mixture, with coke. In the year last named there were 25 furnaces which used bituminous coal alone in the manufacture of pig iron, the quantity of coal consumed amounting to 330,336 tons and the pig iron made to 101,588 tons. In 1890 only 6 furnaces reported the use of bituminous coal alone, the consumption amounting to 136,121 tons and the pig iron produced to 42,712 tons. In 1900, however, the use of bituminous coal alone had been entirely discontinued, not a single furnace in the whole country reporting a ton of pig iron made with this fuel.

In the report for 1890 the fact was mentioned that a marked decline had taken place in that year as compared with 1880 in the use of bituminous coal and coke mixed for manufacturing pig iron, and especially in the proportion of coal used with coke, the former being then much smaller than in 1880. In the year last named the quantity of bituminous coal so used amounted to 608,729 tons, but in 1890 it had fallen to 355,849 tons. In 1900 the consumption of bituminous coal by furnaces which reported having made pig iron with bituminous coal and coke mixed was 135,684 tons, the total production of pig iron amounting to only 90,106 tons. The number of furnaces using this fuel was 6, all located in Kentucky and Ohio. As a rule, the mixture in 1900 consisted of about one-half coal and one-half coke. The bituminous coal reported in the table was, therefore, chiefly used in 1900 under the boilers, the actual quantity so consumed being 695,745 tons. Of course the figures for 1890 and 1880 also include coal used under boilers, as a number of blast furnaces do not have a sufficient supply of waste gases to raise the necessary steam for the operation of the plant. In 1900 a few furnaces used natural gas as well as furnace gases for this purpose.

In 1880 both Illinois and Wisconsin used considerable quantities of anthracite coal and coke mixed in the manufacture of pig iron, but this mixture was not reported by either of the states named in 1900 or 1890.

### PRODUCTS.

Table 32 shows the quantity and value of the pig iron produced in the United States in mineral-fuel furnaces in 1880, 1890, and 1900, classified according to the different kinds of mineral fuel used. The production of spiegeleisen and ferromanganese, and of castings made direct from the furnace, is included for all three periods.

TABLE 32.—BLAST FURNACES, MINERAL FUEL: QUANTITY AND VALUE OF PRODUCTS, 1880 TO 1900.

| CLASSES. | DATE OF CENSUS. | | | | | |
|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | |
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| Total | ..... | $200,676,934 | ..... | $133,685,378 | ..... | $76,739,573 |
| Mixed anthracite coal and coke pig iron | 1,796,000 | 26,066,003 | 1,690,394 | 28,195,996 | 638,027 | 16,627,291 |
| Coke and bituminous coal pig iron | 12,253,818 | 173,763,091 | 6,265,865 | 100,687,256 | 1,354,958 | 35,513,233 |
| Anthracite coal pig iron | 45,857 | 612,702 | 295,434 | 4,772,021 | 994,250 | 23,574,742 |
| Total tonnage and value | 14,095,675 | 200,441,796 | 8,251,693 | 133,655,273 | 2,987,235 | 75,715,266 |
| All other products | ..... | 235,138 | ..... | 30,105 | ..... | 1,024,307 |

[1] Gross ton of 2,240 pounds.

The value of the pig iron produced with mixed anthracite coal and coke decreased in 1900 compared with 1890, the falling off amounting to $2,129,993. Compared with 1880, however, there was an increase in value in 1900 of $9,438,712. The increase in the value of the coke and bituminous coal pig iron in 1900 compared with 1890 was $73,075,835, and compared with 1880 it was $138,249,858. The decrease in 1900 in the value of pig iron produced with anthracite coal alone compared with 1890 was $4,159,319; compared with 1880 it was $22,962,040. The only mineral-fuel pig iron that increased in value in 1900 compared with 1890 was that made with coke and bituminous coal, the other two fuels showing considerable decreases, especially iron made with anthracite coal alone. The fact that the production of mixed anthracite coal and coke pig iron increased in 1900 compared with 1890 to the extent of 105,606 tons, while the value of this class of iron decreased during the same period to the amount of $2,129,993, is worthy of attention.

The $235,138 reported for "all other products" in 1900 include the amount received for custom work and repairing, the sale of furnace slag, the sale of refuse oxide of zinc, etc. More than one-half of the total amount is reported by the state of Illinois. The total increase in the value of all kinds of mineral-fuel pig iron in 1900 over 1890 was $66,786,523, and over 1880 it was $124,726,530.

Table 33 shows by states the production, value, and average price per ton of all kinds of mineral-fuel pig iron in 1880, 1890, and 1900, and the number of completed furnaces in each state in each of the years named. The quantity and value of the spiegeleisen and ferromanganese produced in each of the periods under review is included in the table; also the quantity and value of the direct castings made. The amount received for custom work and repairing, as well as the value of the miscellaneous products reported, are not, however, included in the total value given nor in the average price per ton.

TABLE 33.—BLAST FURNACES, MINERAL FUEL: PRODUCTION, VALUE, AND AVERAGE PRICE PER TON OF PIG IRON, BY STATES, 1880 TO 1900.

| STATES. | Year. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|---|
| United States | 1900 | 325 | [1] 14,095,675 | [1] $200,441,796 | $14.22 |
| | 1890 | 419 | 8,251,693 | 133,655,273 | 16.20 |
| | 1880 | 430 | [2] 2,987,235 | [2] 75,715,266 | 25.35 |
| Alabama | 1900 | 35 | 1,153,674 | 12,645,970 | 10.96 |
| | 1890 | 34 | 720,197 | 8,390,604 | 11.65 |
| | 1880 | 5 | 24,296 | 551,162 | 22.69 |
| Illinois | 1900 | 17 | 1,469,530 | 15,033,696 | 10.23 |
| | 1890 | 15 | 666,676 | 10,136,960 | 15.20 |
| | 1880 | 10 | 85,239 | 2,391,850 | 28.06 |
| Missouri | [3] 1900 | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 60,079 | 1,191,502 | 19.83 |
| | 1880 | 8 | 67,800 | 1,686,780 | 24.88 |
| New Jersey | 1900 | 11 | 150,002 | 2,521,066 | 16.81 |
| | 1890 | 18 | 129,500 | 2,228,724 | 17.21 |
| | 1880 | 20 | 140,548 | 3,410,663 | 24.27 |
| New York | 1900 | 17 | 327,069 | 4,856,559 | 14.85 |
| | 1890 | 28 | 293,205 | 4,850,543 | 16.54 |
| | 1880 | 42 | 260,616 | 5,894,405 | 22.62 |
| Ohio | 1900 | 47 | 2,552,643 | 40,155,408 | 15.73 |
| | 1890 | 60 | 1,183,030 | 19,355,162 | 16.36 |
| | 1880 | 70 | 442,578 | 11,525,927 | 26.04 |
| Pennsylvania | 1900 | 139 | 6,774,243 | $101,435,404 | $14.97 |
| | 1890 | 206 | 4,330,470 | 74,811,310 | 17.28 |
| | 1880 | 233 | 1,692,992 | 43,760,395 | 25.85 |
| Tennessee | 1900 | 11 | 318,716 | 3,858,913 | 12.10 |
| | 1890 | 12 | 218,339 | 2,702,548 | 12.38 |
| | 1880 | 5 | 36,963 | 637,757 | 17.25 |
| Virginia | 1900 | 21 | 426,501 | 6,459,970 | 15.15 |
| | 1890 | 13 | 271,831 | 3,755,651 | 13.82 |
| | 1880 | 7 | 7,515 | 168,120 | 22.37 |
| West Virginia | 1900 | 3 | 188,292 | 3,119,301 | 16.57 |
| | 1890 | 5 | 115,508 | 2,009,505 | 17.39 |
| | 1880 | 6 | 70,298 | 1,580,096 | 22.48 |
| Wisconsin | 1900 | 5 | 182,291 | 2,369,362 | 13.00 |
| | 1890 | 4 | 107,981 | 1,620,117 | 15.00 |
| | 1880 | 3 | 60,306 | 1,688,548 | 28.00 |
| All other states [4] | 1900 | 19 | 552,714 | 7,988,147 | 14.45 |
| | 1890 | 19 | 154,877 | 2,602,647 | 16.80 |
| | 1880 | 21 | 98,084 | 2,419,563 | 24.67 |

[1] Includes 7,113 tons of direct castings, valued at $87,541, and 215,550 tons of spiegeleisen and ferromanganese, valued at $5,871,955.
[2] Includes 3,508 tons of direct castings, valued at $131,248. The 4,229 tons of direct castings, valued at $146,236, as shown in 1880, have been distributed, in tons of 2,240 pounds, between mineral fuel and charcoal pig iron.
[3] Included in "all other states."
[4] Includes establishments distributed as follows: 1900—Colorado, 1; Georgia, 1; Kentucky, 2; Maryland, 2; Minnesota, 1; Missouri, 1; North Carolina, 2. 1890—Colorado, 1; Georgia 2; Indiana, 2; Kentucky, 2; Maryland, 2. 1880—Georgia, 2; Indiana, 2; Kentucky, 3; Maryland, 4; Massachusetts, 1.

The average price reported for the whole country in 1900 for all kinds of mineral-fuel pig iron was $14.22 per ton, against $16.20 per ton in 1890 and $25.35 per ton in 1880. The highest average price per ton in 1900 was reported by New Jersey, namely, $16.81, and the lowest by Illinois, namely, $10.23 per ton. As already stated, a large part of the pig iron made in Illinois was consumed by the makers in the manufacture of steel. In 1890 New Jersey reported an average price per ton of $17.21, compared with $24.27 in 1880. Illinois reported in 1890 an average price of $15.20, against $28.06 in 1880.

West Virginia ranked next to New Jersey in the average price per ton of its mineral-fuel pig iron in 1900, the price realized being $16.57. Ohio ranked third, the average price reported being $15.73 per ton.

Pennsylvania reported an average of $14.97 per ton. The average price realized by the pig-iron makers of Alabama was $10.96 in 1900, 73 cents per ton more than was reported by Illinois. With the single exception of Virginia, all of the states for which details are given in the table report lower average prices per ton in 1900 than were reported in 1890. In Virginia, however, an increase of $1.33 per ton is shown compared with the average price which prevailed ten years ago. This state produced basic pig iron in considerable quantities in 1900. The average value of mixed anthracite coal and coke pig iron in 1900 was $14.51, compared with $16.68 in 1890 and $26.06 in 1880; of coke and bituminous coal pig iron it was $14.18 in 1900, $16.07 in 1890, and $26.21 in 1880; and of pig iron made with anthracite coal alone it was $13.36 in 1900, $16.15 in 1890, and $23.71 in 1880.

### THE MANUFACTURE OF CHARCOAL PIG IRON.

So far as the volume of the output is concerned, the manufacture of pig iron with charcoal as fuel has made little, if any, progress in this country during the last fifty years. In 1854, almost half a century ago, the production of charcoal pig iron amounted to 305,623 gross tons, or 2,056 tons more than were produced in the census year 1900. In the year first named nearly one-half of the pig iron produced in the United States was made with charcoal. The greater part of the remainder was made with anthracite coal alone, the production with bituminous fuel at that time being very small. In the year last named, however, about one-fiftieth of the total production was charcoal pig iron.

Table 34 shows the leading statistics of the manufacture of pig iron with charcoal as fuel during the census years 1880, 1890, and 1900.

TABLE 34.—BLAST FURNACES, CHARCOAL: 1880 TO 1900.[1]

| | 1900 | 1890 | 1880 |
|---|---|---|---|
| Number of establishments | 32 | 83 | 116 |
| Capital | [2]$6,155,839 | [2]$17,626,312 | $19,268,747 |
| Salaried officials, clerks, etc., number | 153 | [3]259 | [4] |
| Salaries | $173,420 | [3]$353,091 | [4] |
| Wage-earners, average number | 1,623 | 3,267 | 16,670 |
| Total wages | $562,420 | $1,196,008 | $4,101,276 |
| Men, 16 years and over | 1,617 | 3,258 | [4] |
| Wages | $561,963 | $1,194,573 | [4] |
| Children, under 16 years | 6 | 9 | [4] |
| Wages | $457 | $1,435 | [4] |
| Miscellaneous expenses | $260,766 | $1,011,955 | [5] |
| Cost of materials used | $3,250,664 | $8,379,150 | $7,365,031 |
| Value of products | $5,344,515 | $11,957,775 | $12,575,996 |
| Tons of pig iron[6] | 303,567 | 593,492 | 388,677 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $273,800; in 1890, at $253,588.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary.
[4] Not reported separately.
[5] Not reported.
[6] Gross ton of 2,240 pounds.

The establishments engaged in the manufacture of charcoal pig iron in 1900 show a decrease as compared with 1890 of 51, and as compared with 1880 of 84. The capital invested by these establishments decreased to the amount of $11,470,473 from 1890 to 1900, the number of wage-earners 1,644, the wages paid $633,588, and the miscellaneous expenses $751,189. No comparisons of these items are made with 1880. The decrease in the cost of the materials used in 1900, compared with 1890, was $5,128,486, and compared with 1880 it was $4,114,367. The value of products in 1900 was $6,613,260 less than the value reported for 1890 and $7,231,481 less than for 1880. In tonnage the output of 1900 was 289,925 tons less than that of 1890; it was also 85,110 tons less than the output of 1880.

Table 35 shows, by states, the number of establishments engaged in the manufacture of charcoal pig iron in the census years 1900, 1890, and 1880, and the capital invested, persons employed, wages paid, cost of materials used, and value of products for the years named.

TABLE 35.—BLAST FURNACES, CHARCOAL: BY STATES, 1880 TO 1900.[1]

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 1900 | 32 | [2]$6,155,839 | 153 | $173,420 | 1,623 | $562,420 | $260,766 | $3,250,664 | $5,344,515 |
| | 1890 | 83 | [2]17,626,312 | [3]259 | [3]353,091 | 3,267 | 1,196,008 | 1,011,955 | 8,379,150 | 11,957,775 |
| | 1880 | 116 | 19,268,747 | [4] | [4] | 16,670 | 4,101,276 | [5] | 7,365,031 | 12,575,996 |
| Alabama | 1900 | 4 | 1,177,689 | 25 | 33,749 | 280 | 75,088 | 35,270 | 500,178 | 841,799 |
| | 1890 | 11 | 3,311,916 | 47 | 78,522 | 625 | 215,469 | [4] | 1,299,025 | 1,925,087 |
| | 1880 | 5 | 1,751,396 | ..... | ..... | 1,266 | 493,456 | ..... | 342,320 | 851,194 |
| Connecticut | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 940,092 | 12 | 16,247 | 117 | 50,634 | [4] | 412,743 | 574,438 |
| | 1880 | 6 | 1,172,000 | ..... | ..... | 139 | 65,974 | ..... | 471,467 | 644,911 |
| Maryland | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 3 | 457,650 | 5 | 5,580 | 122 | 41,487 | [4] | 221,887 | 333,603 |
| | 1880 | 8 | 1,037,125 | ..... | ..... | 673 | 176,479 | ..... | 523,746 | 941,489 |
| Michigan | 1900 | 7 | 2,029,713 | 44 | 64,451 | 513 | 216,030 | 131,047 | 1,404,924 | 2,327,153 |
| | 1890 | 15 | 5,259,001 | 57 | 95,312 | 675 | 321,022 | [4] | 2,935,233 | 3,982,278 |
| | 1880 | 13 | 2,671,386 | ..... | ..... | 2,164 | 561,870 | ..... | 2,091,224 | 3,145,052 |
| New York | [6]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 3 | 593,089 | 5 | 6,800 | 72 | 31,089 | [4] | 248,424 | 332,063 |
| | 1880 | 8 | 777,087 | ..... | ..... | 468 | 140,719 | ..... | 454,462 | 807,144 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $273,800; in 1890, at $253,588.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary.
[4] Not reported separately.
[5] Not reported.
[6] Included in "all other states."

TABLE 35.—BLAST FURNACES, CHARCOAL: BY STATES, 1880 TO 1900[1]—Continued.

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| Ohio | 1900 | 4 | $379,834 | 17 | $7,968 | 112 | $22,333 | $18,722 | $83,328 | $139,350 |
| | 1890 | 9 | 765,094 | 29 | 24,775 | 256 | 60,661 | (2) | 309,235 | 445,106 |
| | 1880 | 17 | 2,980,000 | ..... | ..... | 3,430 | 972,416 | ..... | 916,607 | 1,391,439 |
| Pennsylvania | 1900 | 3 | 174,478 | 5 | 6,440 | 76 | 22,232 | 5,353 | 78,325 | 120,383 |
| | 1890 | 11 | 827,308 | 14 | 16,337 | 201 | 37,152 | (2) | 299,821 | 401,448 |
| | 1880 | 21 | 2,440,000 | ..... | ..... | 1,485 | 384,276 | ..... | 587,727 | 1,188,627 |
| Tennessee | [3]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 4 | 858,721 | 20 | 27,510 | 201 | 80,493 | (2) | 432,838 | 663,916 |
| | 1880 | 6 | 612,000 | ..... | ..... | 956 | 116,030 | ..... | 95,755 | 199,065 |
| Texas | 1900 | 3 | 379,215 | 14 | 9,160 | 248 | 42,661 | 8,229 | 90,439 | 172,468 |
| | [3]1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 40,000 | ..... | ..... | 140 | 27,720 | ..... | 23,580 | 36,000 |
| Virginia | [3]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 281,600 | 11 | 9,030 | 101 | 22,104 | (2) | 99,972 | 169,830 |
| | 1880 | 7 | 891,500 | ..... | ..... | 1,021 | 161,205 | ..... | 129,369 | 261,775 |
| Wisconsin | [3]1900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1890 | 5 | 1,261,881 | 8 | 17,860 | 267 | 129,733 | (2) | 1,083,883 | 1,494,775 |
| | 1880 | 6 | 1,468,218 | ..... | ..... | 618 | 241,817 | ..... | 902,723 | 1,607,180 |
| All other states[4] | 1900 | 11 | 2,014,910 | 48 | 51,652 | 444 | 184,076 | 62,145 | 1,093,470 | 1,743,362 |
| | 1890 | 12 | 3,070,010 | 51 | 55,168 | 630 | 206,164 | (2) | 1,036,089 | 1,635,231 |
| | 1880 | 18 | 3,428,035 | ..... | ..... | 4,310 | 759,314 | ..... | 826,051 | 1,502,110 |

[1] This summary includes only active establishments.
[2] Not reported separately.
[3] Included in "all other states."
[4] Includes establishments distributed as follows: 1900—Connecticut, 1; Georgia, 2; Maryland, 1; Massachusetts, 1; Missouri, 1; New York, 2; Tennessee, 1; Virginia, 1; Wisconsin, 1. 1890—Georgia, 2; Kentucky, 2; Maine, 1; Massachusetts, 1; Missouri, 2; North Carolina, 1; Oregon, 1; Texas, 1; Washington, 1. 1880—Georgia, 3; Indiana, 1; Kentucky, 6; Maine, 1; Massachusetts, 1; Missouri, 2; Oregon, 1; Vermont, 1; West Virginia, 2.

There were 14 states which manufactured charcoal pig iron in the census year 1900, compared with 19 states in 1890 and 20 states in 1880. The states which made charcoal pig iron in 1890 or 1880, but not in 1900, were Maine, Kentucky, North Carolina, Oregon, Washington, and Vermont. The state last named was not a producer in 1890, but all of the other states made pig iron with charcoal as fuel in that year.

In 1880 Indiana, Minnesota, West Virginia, and Utah had charcoal furnaces, but only Indiana and West Virginia produced pig iron in that year. The charcoal stacks in all these states have since been dismantled. California had 1 charcoal furnace in operation in 1881, but it was abandoned prior to 1890.

For many years Michigan has been the leading manufacturer of charcoal pig iron in this country, and in 1900 it still held this position, its production amounting in value in that year to over two-fifths of the total value reported for the whole country. In 1890 the value of its output was about one-third, and in 1880 about one-fourth of the grand total. Alabama was second in 1900 and Wisconsin third, both in the quantity and value of their output. In the former state the value of the pig iron produced in 1900 shows a shrinkage as compared with 1890 of $1,083,288. Compared with 1880, however, the shrinkage was only $9,395. In the latter state a heavy decline in value is also shown as compared with both 1890 and 1880. Compared with 1880 the decrease in the value of the charcoal pig iron produced by Pennsylvania and Ohio in 1900 was especially marked, the falling off amounting to $1,068,244 in the former state, and to $1,252,089 in the latter. During these twenty years the capital invested in Pennsylvania in the manufacture of charcoal pig iron decreased to the extent of $2,265,522. In Ohio the decrease was $2,600,166.

The marked decrease in 1900 compared with 1890 in the number of establishments, in capital invested, in wage-earners, and in the value of products in Michigan and Alabama, the two leading manufacturers of charcoal pig iron, will not escape attention. As shown in the table, the decline in the industry was general, Texas being the only state reporting an increase compared with ten years ago. But in none of the producing states was the decrease so noticeable as in Michigan and Alabama.

## CAPITAL.

Table 36 shows the capital invested in active, idle, and building charcoal blast-furnace establishments in the census years 1880, 1890, and 1900.

TABLE 36.—BLAST FURNACES, CHARCOAL: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 63 | [1]$10,534,044 | $4,549,086 | $5,984,958 |
| | 1890 | 123 | [1]19,936,466 | 9,043,632 | 10,892,834 |
| | 1880 | 215 | 27,989,919 | 7,066,659 | 20,923,260 |
| Active | 1900 | 32 | 6,155,839 | 2,159,026 | 3,996,813 |
| | 1890 | 83 | 17,626,312 | 7,437,083 | 10,189,229 |
| | 1880 | 116 | 19,268,747 | 4,663,159 | 14,605,588 |
| Idle | 1900 | 30 | 4,273,505 | 2,295,060 | 1,978,445 |
| | 1890 | 33 | 2,047,855 | 1,391,150 | 656,705 |
| | 1880 | 96 | 8,561,800 | 2,378,500 | 6,183,300 |
| In course of construction | 1900 | 1 | 104,700 | 95,000 | 9,700 |
| | 1890 | 7 | 262,299 | 215,399 | 46,900 |
| | 1880 | 3 | 159,372 | 25,000 | 134,372 |

[1] Includes rented property valued in 1900 at $324,500; in 1890 at $253,588.

The number of active, idle, and building establishments reported above was 60 less in 1900 than in 1890 and 152 less than in 1880. The number of active establishments in 1900 was only 2 greater than the number of idle establishments in the same year; in 1890 the active exceeded the idle establishments by 50, and in 1880 by 20. The decrease in capital invested in active, idle, and building establishments in 1900 compared with 1890 was $9,402,422, or 47.2 per cent. There was an increase in the capital invested in idle establishments of $2,225,650 in 1900 compared with 1890. In 1880 the charcoal blast-furnace establishments were in operation for an average of 6.45 months, in 1890 for an average of 8.04 months, and in 1900 for an average of 9 months. The 62 active and idle establishments reported 66 completed charcoal furnaces in 1900. Of these furnaces 33 were in operation for some time during the year and 33 were idle.

### MATERIALS USED.

Table 37 shows in detail the quantity and cost of materials used in 1880, 1890, and 1900 in the manufacture of charcoal pig iron. The weight of the iron ore, fluxing materials, mill cinder, and scrap consumed is reported in gross tons, while charcoal is reported in bushels.

TABLE 37.—BLAST FURNACES, CHARCOAL: QUANTITY AND COST OF MATERIALS USED, 1880 TO 1900.

| | 1900 | | 1890 | | 1880 | |
|---|---|---|---|---|---|---|
| | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. |
| Total | | $3,250,664 | | $8,379,150 | | $7,365,031 |
| Domestic iron ore | 597,747 | 1,060,282 | 1,161,693 | 3,601,301 | 836,653 | 3,515,629 |
| Foreign iron ore | ([2]) | ([2]) | 8,109 | 37,236 | ([3]) | ([3]) |
| Fluxing material | 70,446 | 55,298 | 136,526 | 158,169 | 102,381 | 100,569 |
| Charcoal | [4]29,271,512 | 1,744,892 | [4]67,672,156 | 4,523,320 | [4]53,903,228 | 3,678,658 |
| Mill cinder, scrap, etc | 949 | 3,224 | 625 | 2,417 | 13,979 | 69,216 |
| All other materials | | 386,968 | | 56,707 | | 959 |

[1] Gross ton of 2,240 pounds. [2] None reported. [3] Not reported separately. [4] Bushels.

In 1900 compared with 1890, the charcoal furnaces decreased their consumption of domestic and foreign iron ore by 572,055 tons, and compared with 1880 by 238,906 tons; the consumption of fluxing material fell off 66,080 tons compared with 1890, and 31,935 tons compared with 1880; and the consumption of charcoal 38,400,644 bushels compared with 1890, and 24,631,716 bushels compared with 1880. No comparisons of the cost of ore, charcoal, fluxing material, etc., can be made in 1900 with the cost reported for these materials for 1890 and 1880.

The average consumption of domestic and foreign iron ore and mill cinder and scrap per ton of charcoal pig iron made amounted to 4,418 pounds in 1900 compared with 4,415 pounds in 1890 and 4,822 pounds in 1880; of fluxing material to 520 pounds in 1900, compared with 515 pounds in 1890 and 590 pounds in 1880; and of charcoal to 96 bushels in 1900, compared with 114 bushels in 1890 and 139 bushels in 1880.

### PRODUCTS.

Table 38 shows the quantity and value of all kinds of charcoal pig iron for the census years 1880, 1890, and 1900. Direct castings are included for each of the years. No spiegeleisen or ferromanganese was produced with charcoal as fuel in 1900.

TABLE 38.—BLAST FURNACES, CHARCOAL: QUANTITY AND VALUE OF PRODUCTS, 1880 TO 1900.

| | DATE OF CENSUS. | | | | | |
|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | |
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| Total | | $5,344,515 | | $11,957,775 | | $12,575,996 |
| Hot or warm blast charcoal pig iron | 291,499 | 5,061,822 | 560,594 | 11,243,119 | 317,542 | 10,090,244 |
| Cold-blast charcoal pig iron | 12,068 | 276,917 | 32,898 | 714,591 | 71,135 | 2,398,600 |
| Total tonnage and value | 303,567 | 5,338,739 | 593,492 | 11,957,710 | 388,677 | 12,488,744 |
| All other products | | 5,776 | | 65 | | 87,252 |

[1] Gross ton of 2,240 pounds.

The decrease in the production of all kinds of charcoal pig iron in 1900 compared with 1890 was 289,925 tons, and compared with 1880 it was 85,110 tons. The value of the charcoal iron produced in 1900 was $6,618,971 less than the value of the production of 1890 and $7,150,005 less than the value of the production of 1880. The decrease in the production of hot or warm blast charcoal pig iron in 1900 compared with 1890 was 269,095 tons, and compared with 1880 it was 26,043 tons. The decrease in the value of this class of pig iron was $6,181,297 in 1900 compared with 1890 and $5,028,422 compared with 1880.

The production of cold-blast charcoal pig iron in 1900 was 20,830 tons less than in 1890 and 59,067 tons less than in 1880. The value of this class of pig iron decreased $437,674 in 1900 compared with 1890, and $2,121,583 compared with 1880. Of the total production of charcoal pig iron in 1900, 96 per cent was hot or warm blast and 4 per cent was cold blast. In 1890 and 1880 the percentages were as follows: 1890, hot or warm blast, 94.5 per cent; cold blast, 5.5 per cent; 1880, hot or warm blast, 81.7 per cent; cold blast, 18.3 per cent.

So far as can be learned the best monthly, weekly, and daily record of production by a charcoal furnace is held by Hinkle Furnace, at Ashland, Wis., owned and operated by the Ashland Iron and Steel Company. In December, 1894, this furnace produced all told 3,856 gross tons of pig iron. In making this iron the average consumption of iron ore (Gogebic) per ton of pig iron made was 3,924 pounds, of limestone 115 pounds, and of charcoal 78.33 bushels, the average weight per bushel of the charcoal being 22 pounds. The best week's work of the furnace was in the seven days ending with October 4, 1890, when 1,009 tons of pig iron were made, also from Gogebic ore. The average consumption of ore per ton of pig iron produced was 4,021 pounds, while the limestone consumed amounted to 194 pounds, and the charcoal to 82 bushels. The best day's work by this furnace was on October 3, 1890, when it made 150 tons of pig iron from Gogebic ore. The ore consumption amounted to 3,940 pounds per ton of pig iron, the limestone to 161 pounds, and the charcoal to 81.78 bushels.

Table 39 shows, by states, the number of completed furnaces and the production, value, and average price per ton of charcoal pig iron in 1880, 1890, and 1900. Direct castings are included. The amount received for custom work and repairing and for miscellaneous products is, on the other hand, omitted.

TABLE 39.—BLAST FURNACES, CHARCOAL PIG IRON: PRODUCTION, VALUE, AND AVERAGE PRICE PER TON, BY STATES, 1880 TO 1900.

| STATES. | Year. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|---|
| United States | 1900 | 66 | [1] 303,567 | [1] $5,338,789 | $17.59 |
| | 1890 | 140 | 593,492 | 11,957,710 | 20.15 |
| | 1880 | 251 | [2] 388,677 | [2] 12,488,744 | 32.13 |
| Alabama | 1900 | 8 | 49,603 | 841,799 | 16.97 |
| | 1890 | 14 | 97,312 | 1,925,087 | 19.78 |
| | 1880 | 10 | 31,361 | 850,994 | 27.14 |
| Connecticut | [3] 1900 | | | | |
| | 1890 | 9 | 19,870 | 574,438 | 28.91 |
| | 1880 | 8 | 16,767 | 644,911 | 38.46 |
| Maryland | [3] 1900 | | | | |
| | 1890 | 7 | 12,902 | 333,603 | 25.86 |
| | 1880 | 13 | 24,610 | 929,863 | 37.78 |

[1] Includes 10 tons of direct castings, valued at $121.
[2] Includes 300 tons of direct castings, valued at $14,988.
[3] Included in "all other states." The 4,229 tons of direct castings, valued at $146,236, shown in 1880, have been distributed, in tons of 2,240 pounds, between mineral fuel and charcoal pig iron.

TABLE 39.—BLAST FURNACES, CHARCOAL PIG IRON: PRODUCTION, VALUE, AND AVERAGE PRICE PER TON, BY STATES, 1880 TO 1900—Continued.

| STATES. | Year. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|---|
| Michigan | 1900 | 13 | 141,377 | $2,327,153 | $16.46 |
| | 1890 | 26 | 203,417 | 3,982,278 | 19.58 |
| | 1880 | 25 | 106,774 | 3,123,245 | 29.25 |
| New York | [1] 1900 | | | | |
| | 1890 | 9 | 14,240 | 332,063 | 23.32 |
| | 1880 | 15 | 19,177 | 802,944 | 41.87 |
| Ohio | 1900 | 6 | 6,251 | 135,350 | 21.65 |
| | 1890 | 11 | 20,112 | 445,041 | 22.13 |
| | 1880 | 33 | 47,343 | 1,382,359 | 29.20 |
| Pennsylvania | 1900 | 8 | 4,341 | 120,383 | 27.73 |
| | 1890 | 15 | 15,516 | 401,448 | 25.87 |
| | 1880 | 36 | 30,500 | 1,179,633 | 38.68 |
| Tennessee | [1] 1900 | | | | |
| | 1890 | 7 | 45,847 | 663,916 | 14.48 |
| | 1880 | 16 | 5,781 | 187,175 | 32.38 |
| Texas | [2] 1900 | 4 | 9,789 | 172,468 | 17.62 |
| | [1] 1890 | | | | |
| | 1880 | 1 | 1,250 | 36,000 | 28.80 |
| Virginia | [1] 1900 | | | | |
| | 1890 | 18 | 7,068 | 169,830 | 24.03 |
| | 1880 | 24 | 8,473 | 261,575 | 30.87 |
| Wisconsin | [1] 1900 | | | | |
| | 1890 | 6 | 84,111 | 1,494,775 | 17.77 |
| | 1880 | 11 | 45,303 | 1,605,087 | 35.43 |
| All other states [3] | 1900 | 27 | 92,208 | 1,741,586 | 18.89 |
| | 1890 | 18 | 73,097 | 1,635,231 | 22.37 |
| | 1880 | 59 | 51,338 | 1,484,958 | 28.93 |

[1] Included in "all other states." The 4,229 tons of direct castings, valued at $146,236, shown in 1880, have been distributed, in tons of 2,240 pounds, between mineral fuel and charcoal pig iron.
[2] Includes one penal institution.
[3] Includes establishments distributed as follows: 1900—Connecticut, 5; Georgia, 3; Maryland, 2; Massachusetts, 3; Oregon, 1; Missouri, 1; New York, 2; Tennessee, 3; Virginia, 5; Wisconsin, 1. 1890—Georgia, 3; Kentucky, 1; Maine, 1; Massachusetts, 4; Missouri, 3; North Carolina, 1; Oregon, 1; Washington, 1; Texas, 3. 1880—Georgia, 8; Indiana, 1; Kentucky, 18; Maine, 1; Massachusetts, 5; Minnesota, 1; Missouri, 9; North Carolina, 7; Oregon, 1; Utah, 2; Vermont, 1; West Virginia, 5.

The average value per ton of all kinds of charcoal pig iron in 1900 was $17.59, against an average value of $20.15 in 1890 and of $32.13 in 1880. The hot or warm blast pig iron averaged $17.36 per ton in 1900, $20.06 per ton in 1890, and $31.78 per ton in 1880. The cold-blast iron averaged $22.95 per ton in 1900, $21.72 in 1890, and $33.72 in 1880.

The highest average price per ton in 1900 was reported by Pennsylvania, namely, $27.73, compared with $25.87 in 1890 and $38.68 in 1880. In 1900 Pennsylvania made only cold-blast charcoal pig iron, while in 1890 and in 1880 it produced both cold and warm blast iron. Connecticut, which ranked next to Pennsylvania in 1900 in the average price of its pig iron, produced charcoal iron only in 1900, the average price per ton realized being considerably less than that reported for Pennsylvania. In 1890 the average price for the state was considerably higher than the average reported for any of the other charcoal pig-iron producing states. In 1880 New York reported the highest average, the manufacturers in that state having received $41.87 per ton for the charcoal iron made in that year.

The lowest average price reported per ton in 1900 was $16.46 by Michigan, compared with $14.48 in 1890 by Tennessee and $27.14 in 1880 by Alabama.

## THE MANUFACTURE OF MIXED CHARCOAL AND COKE PIG IRON.

During the census year 1900 there were 4 establishments in the United States, all located in the state of Tennessee, which made a specialty of the production of pig iron with a mixture of coke and charcoal as fuel. In addition 1 charcoal furnace in Ohio and 1 coke furnace in Georgia also made small quantities of pig iron with this fuel. The quantity and value of the iron produced by these two states with mixed charcoal and coke, a certain portion of the capital invested, of the salaries paid to officials and clerks, of the amount paid to wage-earners, of the cost of materials, and of the miscellaneous expenses have been added to the figures reported by Tennessee, and are included in the tables which follow. The 2 establishments in Ohio and Georgia, however, do not appear in the 4 establishments reported below, each having been included in its proper industrial branch. As in the census for 1880 and 1890, no pig iron made with mixed charcoal and coke was reported, no comparison with these years is possible.

Table 40 shows the leading statistics of the manufacture of mixed charcoal and coke iron in 1900.

TABLE 40.—BLAST FURNACES, MIXED CHARCOAL AND COKE: SUMMARY, 1900.[1]

| | |
|---|---|
| Number of establishments | [2]4 |
| Capital | $1,367,162 |
| Salaried officials, clerks, etc., number | 30 |
| Salaries | $30,830 |
| Wage-earners, average number | 310 |
| Total wages | $88,272 |
| Men, 16 years and over | 306 |
| Wages | $87,700 |
| Children, under 16 years | 4 |
| Wages | $572 |
| Miscellaneous expenses | $21,146 |
| Cost of materials used | $579,544 |
| Value of products | $801,753 |
| Tons of pig iron[3] | 52,992 |

[1] This summary includes only active establishments. The figures include statistics relating to small quantities of mixed charcoal and coke pig iron reported in 1900 by 1 coke establishment in Georgia and 1 charcoal establishment in Ohio.
[2] Includes establishments in Tennessee only.
[3] Gross ton of 2,240 pounds.

The manufacture of pig iron with this class of fuel is not likely to grow in the near future. It was more or less of an experiment. Since the close of the census year nearly all the establishments enumerated above have discontinued its use and are now using coke alone.

### CAPITAL.

Table 41 shows the capital invested in 1900 by establishments which manufactured pig iron with mixed charcoal and coke as fuel.

TABLE 41.—BLAST FURNACES, MIXED CHARCOAL AND COKE: DISTRIBUTION OF CAPITAL, 1900.

| | |
|---|---|
| Capital: | |
| Total | [1]$1,367,162 |
| Land | 886,423 |
| Buildings | 579,180 |
| Machinery, tools, and implements | 81,251 |
| Cash and sundries | 320,308 |

[1] Includes 4 establishments in Tennessee and a part of the capital for 1 coke establishment in Georgia, and 1 charcoal establishment in Ohio, each of which reported small quantities of mixed charcoal and coke pig iron in 1900.

There were no idle establishments in 1900 which reported stacks equipped for the manufacture of mixed charcoal and coke pig iron. Neither were any furnaces in course of construction for the use of this fuel. The 4 establishments reported above, all in Tennessee, had, all told, 5 stacks, 4 of which were in operation during the census year and 1 idle. In 1900 these furnaces were in operation for an average of 9.75 months.

### MATERIALS USED.

Table 42 shows in detail the quantity and cost of the materials used in 1900 in the manufacture of pig iron with mixed charcoal and coke.

TABLE 42.—BLAST FURNACES, MIXED CHARCOAL AND COKE: QUANTITY AND COST OF MATERIALS USED, 1900.

| | Tons.[1] | Cost. |
|---|---|---|
| Total | | $579,544 |
| Domestic iron ore | 106,901 | 144,825 |
| Fluxing material | 33,124 | 23,869 |
| Charcoal | [2]2,150,073 | 101,309 |
| Coke | 58,105 | 201,951 |
| All other materials | | 107,590 |

[1] Gross ton of 2,240 pounds. [2] Bushels.

The average consumption of domestic iron ore in 1900 in producing a ton of mixed charcoal and coke pig iron was 4,519 pounds; of fluxing material, 1,400 pounds; of charcoal, 41 bushels; and of coke, 2,456 pounds. In some of the furnaces a mixture of one-half coke and one-half charcoal was used; at others, however, the mixture was one-fourth coke and three-fourths charcoal. Much of the iron made was high in silicon and phosphorus and low in sulphur, and was especially suitable for foundry purposes.

### PRODUCTS.

Table 43 shows the quantity and value of mixed charcoal and coke pig iron produced in the census year 1900 in Tennessee, Georgia, and Ohio. Of the three states named, Tennessee alone manufactured it as a regular product, the establishments in Georgia and Ohio (one in each state) having in addition made bituminous or charcoal pig iron during the census year.

TABLE 43.—BLAST FURNACES, MIXED CHARCOAL AND COKE: QUANTITY AND VALUE OF PRODUCTS, 1900.

| | Tons.[1] | Value. |
|---|---|---|
| Total | | $801,753 |
| Hot or warm blast charcoal and coke pig iron | 52,992 | 798,865 |
| All other products | | 2,888 |

[1] Gross ton of 2,240 pounds.

Table 44 shows the production, value, and average price per ton of mixed charcoal and coke pig iron in 1900; also the number of completed furnaces which used this fuel in the year named. No direct castings were made; neither was spiegeleisen or ferromanganese produced. The value of the miscellaneous products turned out in 1900 amounted to $2,888, which is not included in the table. Mixed charcoal and coke pig iron was not reported in the census for 1890 or 1880.

TABLE 44.—BLAST FURNACES, MIXED CHARCOAL AND COKE PIG IRON: PRODUCTION, VALUE, AND AVERAGE PRICE PER TON, BY STATES, 1900.

| STATES. | Number of completed furnaces. | Gross tons. | Value. | Average price per ton. |
|---|---|---|---|---|
| United States | 5 | 52,992 | $798,865 | $15.08 |
| Tennessee | 5 | 51,552 | 770,616 | 14.95 |
| Ohio and Georgia | | [1] 1,440 | [1] 28,249 | 19.62 |

[1] Includes 800 tons, valued at $18,000, produced by a charcoal furnace in Ohio, and 640 tons, valued at $16,249, produced by a coke furnace in Georgia.

The average value per ton of the mixed charcoal and coke pig iron produced in Tennessee in 1900 was $14.95 per ton; in Ohio it was $22.50 per ton; and in Georgia it was $16.01 per ton. For the three states named it was $15.08 per ton.

## PART III.—THE MANUFACTURE OF STEEL INGOTS AND STEEL CASTINGS AND OF ROLLED IRON AND STEEL.

### ROLLING MILLS AND STEEL WORKS.

In the census reports for 1890 and 1880 the statistics of the production of rolled iron and rolled steel were separately reported. In the census of 1900, however, it was not found possible to continue this separation. The production of all kinds of steel ingots and direct steel castings was, however, ascertained for the period last named, and complete details for this branch of the steel industry will be found in tables printed on subsequent pages.

Table 45 shows the leading statistics for rolling mills and steel works for 1900, 1890, 1880, and 1870.

TABLE 45.—ROLLING MILLS AND STEEL WORKS, 1870 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.[1]

| | DATE OF CENSUS. | | | | PER CENT OF INCREASE. | | |
|---|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880[2] | 1870[2] | 1890 to 1900. | 1880 to 1890. | 1870 to 1880. |
| Number of establishments | 438 | 395 | 358 | 340 | 10.9 | 10.3 | 5.3 |
| Capital | [3] $441,795,983 | [3] $278,559,831 | $116,458,390 | $61,120,015 | 58.6 | 139.2 | 90.5 |
| Salaried officials, clerks, etc., number | 7,442 | [4] 3,242 | [5] | [5] | 129.5 | ..... | ..... |
| Salaries | $9,421,868 | [4] $4,833,240 | [5] | [5] | 94.9 | ..... | ..... |
| Wage-earners, average number | 183,023 | 137,295 | 96,164 | 47,099 | 33.3 | 42.8 | 104.2 |
| Total wages | $102,238,692 | $74,460,433 | $41,880,687 | $26,843,767 | 37.3 | 77.8 | 56.0 |
| Men, 16 years and over | 180,148 | 135,184 | 89,645 | 45,256 | 33.3 | 50.7 | 98.1 |
| Wages | $101,579,174 | $74,041,279 | [5] | [5] | 37.2 | ..... | ..... |
| Women, 16 years and over | 1,065 | 58 | 33 | 26 | 1,736.2 | 75.8 | 26.9 |
| Wages | $265,536 | $17,106 | [5] | [5] | 1,452.3 | ..... | ..... |
| Children, under 16 years | 1,810 | 2,103 | 6,486 | 1,817 | [6] 13.9 | [6] 67.6 | 257.0 |
| Wages | $393,982 | $402,048 | [5] | [5] | [6] 2.0 | ..... | ..... |
| Miscellaneous expenses | $24,795,663 | $11,817,593 | [7] | [7] | 109.8 | ..... | ..... |
| Cost of materials used | $390,568,117 | $216,269,022 | $130,104,493 | $84,342,649 | 80.6 | 66.2 | 54.3 |
| Value of products | $596,689,284 | $331,860,872 | $203,274,042 | $129,921,144 | 79.8 | 63.3 | 56.5 |
| Tons of products[8] | 15,040,129 | 7,388,244 | 3,046,038 | 1,331,773 | 103.6 | 142.6 | 128.7 |

[1] This summary includes only active establishments for 1880, 1890, and 1900; such establishments were not reported separately in 1870.
[2] See remarks in regard to the depreciated currency of 1870.
[3] Includes rented property valued in 1900 at $11,835,940; in 1890 at $3,212,000.
[4] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Table 72.)
[5] Not reported separately.
[6] Decrease.
[7] Not reported.
[8] Gross ton of 2,240 pounds.

The gain over the two preceding census periods in the number of active establishments which were equipped for the manufacture of steel or of rolled iron and steel was 43 in 1900 compared with 1890 and 80 compared with 1880. In 1870 active and idle establishments were not separately reported.

In 1900 a little less than three-fourths of the aggregate capital invested in active iron and steel establishments was reported by plants engaged in the manufacture of steel and rolled iron and steel, compared with a little over two-thirds similarly invested in 1890. The increase in capital in establishments engaged in the manufacture of steel ingots and castings and of rolled iron and steel in the ten years amounted to $163,236,152, or 58.6 per cent; in wage-earners to 45,728, or 33.3 per cent; in wages to $27,778,259, or

37.3 per cent; in miscellaneous expenses to $12,978,070, or 109.8 per cent; in the cost of materials used to $174,299,095, or 80.6 per cent; in the value of products to $264,828,412, or 79.8 per cent; and in tonnage to 7,651,885, or 103.6 per cent.

Comparing 1900 with 1880 and 1870, it is shown in Table 45 that the invested capital increased in 1900, compared with 1880, to the amount of $325,337,593, or 279.4 per cent, and compared with 1870 to $380,675,968, or 622.8 per cent. In the average number of wage-earners employed the increase in 1900 over 1880 was 86,859, or 90.3 per cent, and over 1870 it was 135,924, or 288.6 per cent. The wages paid were $60,358,005 greater in 1900 than in 1880 (percentage of increase, 144.1), and $75,394,925 greater than in 1870 (percentage of increase, 280.9). The cost of the materials used increased in 1900 over 1880 to the amount of $260,463,624, or 200.2 per cent, and over 1870 to $306,225,468, or 363.1 per cent. The value of the products in 1900 was $393,415,242 (193.5 per cent) greater than in 1880 and $466,768,140 (359.3 per cent) greater than in 1870. The increased output in 1900 over 1880 was 11,994,091 tons, or 393.8 per cent, and over 1870 it was 13,708,356 tons, or 1,029.3 per cent.

Table 46 shows the number of establishments which produced steel ingots or castings and hot-rolled iron and steel in 1900, 1890, and 1880, by states, and the capital invested, number of salaried officials, salaries paid these officials, number of wage-earners, amount paid in wages, miscellaneous expenses, cost of materials, and value of products. Active establishments only are included.

TABLE 46.—ROLLING MILLS AND STEEL WORKS: BY STATES, 1880 TO 1900.[1]

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 1900 | 438 | [2]$441,795,983 | 7,442 | $9,421,868 | 183,023 | $102,238,692 | $24,795,663 | $390,568,117 | $596,689,284 |
| | 1890 | 395 | [2]278,559,831 | [3]3,242 | [3]4,833,240 | 137,295 | 74,460,433 | 11,817,593 | 216,269,022 | 331,860,872 |
| | 1880 | 358 | 116,458,390 | [4] | [4] | 96,164 | 41,880,687 | [5] | 130,104,493 | 203,274,042 |
| Alabama | 1900 | 6 | 4,401,295 | 34 | 55,548 | 2,204 | 1,072,384 | 107,737 | 2,451,824 | 3,904,714 |
| | 1890 | 7 | 2,208,797 | 43 | 56,648 | 1,696 | 681,660 | 157,463 | 937,460 | 2,228,536 |
| | 1880 | 1 | 50,000 | ..... | ..... | 60 | 18,000 | ..... | 25,400 | 47,500 |
| California | 1900 | 3 | 1,499,162 | 18 | 22,250 | 555 | 327,184 | 18,944 | 506,834 | 900,854 |
| | 1890 | 4 | 4,656,611 | 38 | 56,549 | 1,114 | 693,300 | 208,088 | 1,938,333 | 3,097,155 |
| | 1880 | 1 | 1,000,000 | ..... | ..... | 319 | 177,722 | ..... | 535,500 | 780,000 |
| Connecticut | 1900 | 7 | 4,792,902 | 72 | 107,775 | 1,785 | 939,243 | 188,313 | 2,198,682 | 4,066,836 |
| | 1890 | 8 | 1,249,429 | 29 | 39,537 | 532 | 311,771 | 56,627 | 911,335 | 1,463,180 |
| | 1880 | 11 | 1,385,000 | ..... | ..... | 546 | 265,210 | ..... | 869,758 | 1,353,787 |
| Delaware | 1900 | 6 | 4,207,079 | 81 | 132,677 | 1,490 | 705,366 | 140,054 | 1,635,762 | 3,159,641 |
| | 1890 | 7 | 2,558,865 | 53 | 78,061 | 1,637 | 765,158 | 43,201 | 1,549,539 | 2,608,670 |
| | 1880 | 8 | 1,341,469 | ..... | ..... | 867 | 344,476 | ..... | 1,214,050 | 2,347,177 |
| Illinois | 1900 | 22 | 32,672,326 | 570 | 631,567 | 13,632 | 7,464,442 | 2,516,516 | 30,021,296 | 45,149,498 |
| | 1890 | 19 | 24,334,645 | 168 | 246,193 | 7,265 | 4,324,853 | 577,876 | 21,951,521 | 28,872,741 |
| | 1880 | 13 | 4,845,620 | ..... | ..... | 4,755 | 2,323,664 | ..... | 13,214,536 | 18,153,439 |
| Indiana | 1900 | 27 | 14,994,210 | 205 | 266,764 | 7,579 | 4,243,831 | 376,844 | 12,438,754 | 19,338,481 |
| | 1890 | 13 | 3,888,254 | 63 | 95,013 | 2,581 | 1,120,779 | 169,435 | 2,889,615 | 4,505,536 |
| | 1880 | 9 | 1,828,000 | ..... | ..... | 1,740 | 810,081 | ..... | 2,957,467 | 4,090,868 |
| Kentucky | 1900 | 6 | 3,134,287 | 73 | 91,669 | 1,766 | 949,047 | 120,818 | 3,116,331 | 5,004,572 |
| | 1890 | 5 | 1,484,456 | 32 | 46,651 | 1,173 | 582,007 | 65,990 | 1,241,536 | 2,059,840 |
| | 1880 | 9 | 2,512,000 | ..... | ..... | 2,205 | 914,412 | ..... | 2,422,389 | 3,841,377 |
| Maryland | 1900 | 5 | 2,047,314 | 40 | 58,499 | 1,419 | 703,445 | 351,622 | 4,260,326 | 5,540,179 |
| | 1890 | 4 | 1,071,352 | 16 | 16,828 | 557 | 194,181 | 20,747 | 766,849 | 1,062,204 |
| | 1880 | 5 | 2,145,000 | ..... | ..... | 1,253 | 546,974 | ..... | 1,829,042 | 2,550,051 |
| Massachusetts | 1900 | 7 | 13,608,604 | 93 | 155,217 | 6,099 | 3,401,995 | 989,570 | 7,490,732 | 13,412,379 |
| | 1890 | 14 | 8,344,394 | 122 | 175,664 | 5,168 | 2,454,035 | 169,937 | 6,786,610 | 10,981,649 |
| | 1880 | 21 | 5,526,408 | ..... | ..... | 6,115 | 2,399,975 | ..... | 6,486,372 | 9,973,911 |
| Michigan | 1900 | 3 | 1,904,337 | 28 | 30,625 | 1,459 | 725,061 | 146,780 | 2,365,289 | 3,574,905 |
| | 1890 | 4 | 1,437,540 | 25 | 44,444 | 752 | 435,339 | 98,096 | 1,200,758 | 1,847,565 |
| | 1880 | 2 | 671,000 | ..... | ..... | 925 | 360,727 | ..... | 1,188,196 | 1,446,551 |
| Missouri | 1900 | 5 | 2,195,309 | 52 | 81,566 | 1,604 | 881,917 | 72,378 | 1,605,392 | 3,200,230 |
| | 1890 | 4 | 1,612,443 | 18 | 28,039 | 642 | 393,896 | 102,786 | 831,566 | 1,520,559 |
| | 1880 | 5 | 3,020,000 | ..... | ..... | 1,789 | 447,464 | ..... | 1,412,934 | 2,185,513 |
| New Jersey | 1900 | 16 | 17,861,970 | 282 | 452,357 | 7,699 | 3,600,728 | 1,056,365 | 14,322,831 | 21,835,484 |
| | 1890 | 19 | 8,525,996 | 129 | 212,812 | 4,498 | 2,301,592 | 504,967 | 5,326,401 | 8,756,431 |
| | 1880 | 18 | 5,005,550 | ..... | ..... | 3,495 | 1,412,622 | ..... | 3,914,970 | 6,704,054 |
| New York | 1900 | 20 | 9,243,471 | 191 | 293,867 | 4,344 | 2,410,275 | 211,984 | 4,093,932 | 8,697,995 |
| | 1890 | 19 | 9,321,793 | 127 | 199,862 | 5,291 | 2,672,451 | 486,805 | 5,932,461 | 10,310,088 |
| | 1880 | 24 | 8,702,000 | ..... | ..... | 7,437 | 2,725,191 | ..... | 8,264,186 | 13,924,622 |
| Ohio | 1900 | 64 | 63,181,422 | 945 | 1,250,220 | 27,638 | 16,443,825 | 3,134,600 | 67,785,834 | 98,568,619 |
| | 1890 | 55 | 25,892,390 | 453 | 663,638 | 19,489 | 11,405,904 | 1,552,785 | 28,854,636 | 45,406,560 |
| | 1880 | 41 | 9,805,020 | ..... | ..... | 11,127 | 5,539,913 | ..... | 14,848,295 | 21,880,167 |

[1] This summary includes only active establishments.
[2] Includes rented property valued in 1900 at $11,835,940; in 1890 at $3,212,000.
[3] Includes proprietors and firm members, with their salaries; number only reported in 1900, and not included above. (See Table 72.)
[4] Not reported separately.
[5] Not reported.

TABLE 46.—ROLLING MILLS AND STEEL WORKS: BY STATES, 1880 TO 1900[1]—Continued.

| STATES. | Year. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Number. | Salaries. | Average number. | Total wages. | | | |
| Pennsylvania | 1900 | 209 | $247,001,768 | 4,450 | $5,390,828 | 94,664 | $53,817,488 | $14,573,593 | $218,860,649 | $332,588,174 |
| | 1890 | 186 | 166,691,801 | 1,738 | 2,564,584 | 76,609 | 42,356,589 | 7,072,834 | 122,530,544 | 188,714,190 |
| | 1880 | 158 | 60,489,929 | ..... | ..... | 43,832 | 20,099,576 | ..... | 61,564,160 | 98,445,709 |
| Tennessee | 1900 | 3 | 129,570 | 15 | 14,986 | 216 | 100,375 | 12,158 | 235,573 | 387,409 |
| | 1890 | 4 | 927,549 | 21 | 30,830 | 460 | 218,699 | 91,295 | 492,789 | 881,404 |
| | 1880 | 5 | 1,401,000 | ..... | ..... | 1,350 | 376,786 | ..... | 859,965 | 1,369,400 |
| Virginia | 1900 | 4 | 1,913,944 | 34 | 61,905 | 1,503 | 452,020 | 87,915 | 1,124,356 | 1,836,670 |
| | 1890 | 6 | 2,174,787 | 40 | 65,701 | 1,742 | 639,347 | 100,471 | 1,584,285 | 2,400,603 |
| | 1880 | 5 | 838,000 | ..... | ..... | 1,134 | 352,539 | ..... | 1,199,698 | 1,986,416 |
| West Virginia | 1900 | 8 | 7,122,357 | 81 | 108,426 | 3,975 | 2,066,289 | 166,378 | 8,729,280 | 13,394,911 |
| | 1890 | 8 | 5,012,842 | 63 | 86,687 | 3,346 | 1,552,589 | 88,289 | 6,402,189 | 8,647,360 |
| | 1880 | 8 | 2,390,191 | ..... | ..... | 3,228 | 1,301,658 | ..... | 2,326,014 | 4,422,936 |
| Wisconsin | 1900 | 7 | 4,026,564 | 65 | 73,624 | 1,370 | 909,117 | 252,093 | 3,894,932 | 6,004,989 |
| | [2]1890 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1880 | 1 | 700,000 | ..... | ..... | 1,300 | 647,577 | ..... | 1,729,274 | 3,284,556 |
| All other states[3] | 1900 | 10 | 5,858,092 | 113 | 141,488 | 2,022 | 1,024,660 | 271,001 | 3,929,508 | 6,122,744 |
| | 1890 | 9 | 6,665,887 | 64 | 125,499 | 2,743 | 1,356,280 | 249,901 | 4,146,595 | 6,596,601 |
| | 1880 | 13 | 2,802,203 | ..... | ..... | 2,687 | 816,120 | ..... | 3,242,297 | 4,486,008 |

[1] This summary includes only active establishments.
[2] Included in "all other states."
[3] Includes establishments distributed as follows: 1900—Colorado, 2; Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1. 1890—Colorado, 1; Georgia, 1; Iowa, 1; Maine, 1; Minnesota, 1; New Hampshire, 1; Rhode Island, 1; Wisconsin, 1; Wyoming, 1. 1880—Colorado, 1; District of Columbia, 1; Georgia, 1; Kansas, 2; Maine, 2; Nebraska, 1; New Hampshire, 2; Rhode Island, 1; Vermont, 1; Wyoming, 1.

There were 27 states which produced steel ingots or castings or rolled iron or steel in 1900, compared with 27 states and territories in 1890, and 29 in 1880. In the year last named, Nebraska, Vermont, and the District of Columbia appeared among the producing states, but in 1890 all three had ceased to manufacture steel or roll iron or steel. In the decade from 1890 to 1900 New Hampshire, Georgia, and Iowa also gave up the manufacture of these products, although since the close of the census year the manufacture of rolled iron and steel has been revived in Georgia, this state having two completed rolling mills in January, 1902. Oregon and Washington appear as new producers in 1900, the former state having turned out its first rolled products in September, 1892, and the latter in May, 1895. Minnesota, which did not report rolled products in 1880, produced its first rolled material in October, 1889, its production, therefore, being included in the census compilations for 1890.

Pennsylvania ranked first in the value of its cast steel and rolled iron and steel products during the three periods covered by the table, the value of its output in 1900 amounting to 55.7 per cent of the total value reported for the whole country, compared with 56.9 per cent in 1890 and 48.4 per cent in 1880. In 1900 its products exceeded in value by $68,487,064 the combined value of all other iron and steel manufacturing states, as compared with a similar excess in 1890 of $45,567,508. In 1880, however, the value of the products of all other iron and steel manufacturing states exceeded the value reported by Pennsylvania by $6,382,624. While many of the rolling mills and steel works of this state are located east of the Allegheny Mountains, some being equipped with the latest improved machinery and appliances and employing thousands of workmen, the majority of its large and modern establishments are to be found west of the mountains named, and especially in Allegheny county, which in 1900 reported 60 establishments for the manufacture of steel ingots or castings or rolled iron or steel. These establishments gave employment to 41,586 wage-earners, whose earnings amounted to $25,082,973, and they turned out finished iron and steel products to the value of $182,696,424, or within $2,195,658 of the combined production of the four leading states outside of Pennsylvania, namely, Ohio, Illinois, New Jersey, and Indiana.

As shown by the details given in the table, Pennsylvania reported in 1900 considerably over one-half of the total capital invested by the whole country in the manufacture of steel and of rolled iron and steel; employed over one-half of the total number of wage-earners; paid these wage-earners more than one-half of the total wages reported; paid for materials used considerably over one-half the total cost reported, and, as already stated, manufactured iron and steel products greatly in excess of the value reported by all the other iron and steel manufacturing states in the Union. While, as has been shown heretofore, this state is far in the lead of all other states as a producer of pig iron, its preeminence as a manufacturer of steel and of rolled iron and steel is even more pronounced. The growth of this branch of its iron and steel industry during the decade from 1890 to 1900 can be better appreciated, perhaps, by calling attention to the fact that the value of its steel and rolled iron and steel products in 1900 exceeded by $727,302 the total value reported for the whole country (including Pennsylvania) in 1890, the figures being as follows: Total value of products reported in 1890 by all rolling mills and steel works, $331,860,872; value of similar products reported by

Pennsylvania only in 1900, $332,588,174; excess of value reported by Pennsylvania in 1900 over the value reported for the whole country (including Pennsylvania) in 1890, $727,302.

Ohio ranked second in 1900 in the value of its cast steel and rolled iron and steel products, its increase in that year amounting to $53,162,059, or 117.1 per cent, over 1890, and to $76,688,452, or 350.5 per cent, over 1880. Illinois ranked third, having increased the value of its products in 1900 over 1890 by $16,276,757, or 56.4 per cent, and over 1880 by $26,996,059, or 148.7 per cent. New Jersey ranked fourth, the increased value of its products in 1900 over 1890 amounting to $13,079,053, or 149.4 per cent, and over 1880 to $15,131,430, or 225.7 per cent. Indiana ranked fifth, the value of its products having increased in 1900 over 1890 by $14,832,945, or 329.2 per cent, and over 1880 by $15,247,613, or 372.7 per cent. Massachusetts was sixth in rank, West Virginia seventh, New York eighth, Wisconsin ninth, and Maryland tenth, the value of the products in the state last named amounting in 1900 to $5,540,179. With the single exception of Kentucky, no other state for which details are given in the table produced in 1900 over $5,000,000 worth of steel castings or hot rolled iron or steel products.

## CAPITAL.

Table 47 shows in detail the capital invested in active, idle, and building rolling mill and steel works establishments for 1880, 1890, and 1900.

TABLE 47.—ROLLING MILLS AND STEEL WORKS: DISTRIBUTION OF CAPITAL IN ACTIVE AND IDLE ESTABLISHMENTS AND THOSE IN COURSE OF CONSTRUCTION, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 505 | [1]$455,166,752 | $218,072,234 | $237,094,518 |
| | 1890 | 440 | [1]285,796,684 | 134,143,477 | 151,653,207 |
| | 1880 | 397 | 121,424,745 | 71,702,596 | 49,722,149 |
| Active | 1900 | 438 | 441,795,983 | 208,249,924 | 233,546,059 |
| | 1890 | 395 | 278,559,831 | 128,623,160 | 149,936,671 |
| | 1880 | 358 | 116,458,390 | 69,033,147 | 47,425,243 |
| Idle | 1900 | 38 | 8,130,487 | 5,775,507 | 2,354,980 |
| | 1890 | 34 | 5,711,693 | 4,366,017 | 1,345,676 |
| | 1880 | 33 | 4,064,355 | 2,534,449 | 1,529,906 |
| In course of construction | 1900 | 29 | 5,240,282 | 4,046,803 | 1,193,479 |
| | 1890 | 11 | 1,525,160 | 1,154,300 | 370,860 |
| | 1880 | 6 | 902,000 | 135,000 | 767,000 |

[1] Includes rented property valued in 1900 at $11,916,835; in 1890 at $3,230,000.

The increase in the aggregate capital invested in active, idle, and building establishments in 1900 over 1890 was $169,370,068, or 59.3 per cent; as compared with 1880 the increase was $333,742,007, or 274.9 per cent. Of the aggregate capital reported in 1900, 97.1 per cent was invested in active establishments, 1.8 per cent in idle establishments, and 1.1 per cent in building establishments, compared with similar investments in 1890 of 97.5 per cent in active establishments, 2 per cent in idle establishments, and 0.5 per cent in building establishments, and in 1880 of 95.9 per cent in active establishments, 3.4 per cent in idle establishments, and 0.7 per cent in building establishments.

Of the aggregate capital reported for 1900, 47.9 per cent was invested in buildings, machinery, tools, and implements, and 52.1 per cent in land, cash, and sundries, compared with 46.9 per cent in the former and 53.1 per cent in the latter in 1890, and 59.1 per cent in the former and 40.9 per cent in the latter in 1880. It will be observed that the increase in capital invested in buildings, machinery, tools, and implements in 1900 over 1890 amounted to $83,928,757, and over 1880 to $146,369,638, while the increase in land, cash, and sundries in 1900 over 1890 amounted to $85,441,311, and over 1880 to $187,372,369.

The idle establishments in 1900, 38 in all, an increase of 4 compared with 1890 and 5 compared with 1880, were located in the following states: Maine, 1; New York, 3; New Jersey, 3; Pennsylvania, 15; Maryland, 1; Virginia, 2; West Virginia, 1; Kentucky, 1; Tennessee, 1; Alabama, 3; Indiana, 2; Illinois, 1; Minnesota, 2; Wisconsin, 1; and California, 1. The capital invested in idle plants in 1900 shows an increase of $2,418,794 compared with 1890 and $4,066,132 compared with 1880.

The establishments in course of construction in 1900, 29 in all, an increase of 18 compared with 1890 and of 23 compared with 1880, were located as follows: Massachusetts, 1; New York, 1; Pennsylvania, 9; West Virginia, 1; Kentucky, 1; Alabama, 2; Georgia, 1; Ohio, 6; Indiana, 2; Illinois, 3; and Missouri, 2. The capital invested in building plants in 1900 was greatly in excess of the amount reported at either of the two previous census periods, exceeding by $3,715,122 the investment of 1890 and by $4,338,282 the investment of 1880.

In 1900 there were 505 active, idle, and building rolling-mill and steel-works establishments, of which 438 were active, 38 were idle, and 29 were in course of construction. Of the total completed establishments, 42 were equipped for the manufacture of Bessemer steel, 96 were equipped for the manufacture of open-hearth steel, 40 were equipped for the manufacture of crucible steel, and 11 were equipped for the manufacture of steel by miscellaneous processes. The Bessemer establishments contained 91 converters, the open-hearth establishments 331 furnaces (152 acid and 179 basic), and the crucible establishments 2,619 pots that could be used at a heat. Of the total number of completed rolling-mill and steel-works establishments 425 were equipped for the manufacture of hot-rolled iron and steel products, while 51 were not so equipped. Of the 29 establishments in course of construction 18 were being equipped for the manufacture of hot-rolled iron and steel and 11 for the manufacture of steel castings.

In 1890 the number of active, idle, and building rolling mill and steel works establishments amounted to 440, of which 299 produced rolled iron or steel, but not steel ingots or castings; 130 were equipped for the production of Bessemer, open-hearth, crucible, or miscellaneous steel; and 11 unclassified establishments were in course of construction. Of the 130 steel establishments 51 were equipped to manufacture Bessemer steel (including 6 Clapp-Griffiths and 5 Robert-Bessemer establishments), 58 to manufacture open-hearth steel, 44 to manufacture crucible steel, and 7 to manufacture blister and other kinds of steel.

Of the total steel-producing establishments, 16 controlled or operated both Bessemer converters and open-hearth furnaces, 1 controlled a Bessemer and a special steel plant, 10 controlled or operated both open-hearth and crucible furnaces, and 3 controlled or operated both crucible and blister-steel furnaces. Of the 429 completed establishments reported, 406 were equipped with hot trains of rolls and 23 were not so equipped, the latter establishments making a specialty of the production of steel castings or steel in forms suitable for manipulation under hammers.

The 130 steel-producing establishments reported in 1890 contained 80 standard Bessemer converters, 9 Clapp-Griffiths converters, 8 Robert-Bessemer converters, 129 open-hearth steel furnaces, and 2,606 crucible pots that could be used at a heat.

In 1880 there were 397 active, idle, and building rolling mills and steel works establishments in the United States. Of this number 36 were equipped with Bessemer converters or open-hearth steel furnaces and 37 with crucible furnaces or with furnaces for the production of steel by miscellaneous processes. The Bessemer establishments had 24 converters, the open-hearth establishments 37 steel-melting furnaces, and the crucible steel establishments 2,691 pots that could be used at a heat. Similar details for 1870 are not available.

### MATERIALS USED.

Table 48 shows the quantity and cost of the principal materials used by rolling mills and steel works in 1900, 1890, and 1880, and the percentage of increase or decrease, both for tonnage and value, for 1900 and 1890. The charcoal consumed is reported in bushels and the oil used as fuel in barrels; all other quantities are reported in gross tons of 2,240 pounds.

TABLE 48.—ROLLING MILLS AND STEEL WORKS: QUANTITY AND COST OF MATERIALS USED, 1880 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

| | DATE OF CENSUS. | | | | | | PER CENT OF INCREASE. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1900 | | 1890 | | 1880 | | 1890 to 1900. | | 1880 to 1890. | |
| | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons.[1] | Cost. | Tons. | Cost. | Tons. | Cost. |
| Total | ..... | $390,568,117 | ..... | $216,269,022 | ..... | $130,104,493 | ..... | 80.6 | ..... | 66.2 |
| Iron ore | 340,028 | 1,326,395 | 519,199 | 3,355,139 | 333,405 | 2,779,879 | [2]34.5 | [2]60.5 | 55.7 | 20.7 |
| Spiegeleisen, ferromanganese, and all other pig iron | 10,410,281 | 151,042,348 | 5,846,906 | 105,346,851 | 2,361,304 | 61,868,776 | 78.0 | 43.4 | 147.6 | 70.3 |
| Old iron or steel rails, and other scrap iron and steel | 4,113,287 | 66,670,855 | 1,726,162 | 36,101,038 | 1,198,842 | 37,692,774 | 138.3 | 84.7 | 44.0 | [2]4.2 |
| Purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets and bars | 32,720 | 1,150,575 | 49,867 | 2,329,138 | 92,261 | 5,993,145 | [2]34.4 | [2]50.6 | [2]46.0 | [2]61.1 |
| Purchased muck or scrap bar | 161,329 | 4,585,939 | 209,534 | 6,252,594 | 47,995 | 2,869,544 | [2]23.0 | [2]27.5 | 336.6 | 163.9 |
| Purchased iron or steel ingots, blooms, billets, tin-plate bars, sheet bars or slabs—except imported Swedish billets and bars | 3,682,407 | 92,123,412 | 874,518 | 28,753,506 | 68,882 | 4,330,057 | 321.1 | 220.4 | 1,169.6 | 562.7 |
| Purchased wire rods | 136,725 | 5,419,617 | [3] | [3] | [3] | [3] | ..... | ..... | ..... | ..... |
| Anthracite coal and culm | 944,018 | 1,220,694 | 858,071 | 1,487,713 | 631,229 | 1,875,062 | 10.0 | [2]17.9 | 35.9 | [2]20.7 |
| Bituminous coal and slack | 10,944,046 | 14,679,804 | 4,617,055 | 9,663,208 | 4,112,222 | 10,510,255 | 137.0 | 51.9 | 12.3 | [2]8.1 |
| Coke | 827,246 | 2,014,390 | 350,938 | 1,311,588 | 127,326 | 582,901 | 135.7 | 53.6 | 175.6 | 125.0 |
| Charcoal | [4]2,250,022 | 170,345 | [4]2,770,611 | 243,773 | [4]2,667,902 | 234,379 | [2]18.8 | [2]30.1 | 3.8 | 4.0 |
| Natural gas used as fuel | ..... | 3,098,409 | ..... | 3,566,946 | ..... | ..... | ..... | [2]13.1 | ..... | ..... |
| Oil used as fuel | [5]1,302,615 | 1,158,748 | [5]1,859,138 | 1,124,206 | ..... | ..... | [2]29.9 | 3.1 | ..... | ..... |
| All other materials | ..... | 45,956,586 | ..... | 16,733,322 | ..... | 1,858,721 | ..... | 174.6 | ..... | 800.3 |

[1] Gross ton of 2,240 pounds. [2] Decrease. [3] Not reported separately. [4] Bushels. [5] Barrels.

Attention has already been called to the decreased use of iron ore in 1900 compared with 1890 by rolling mills, due chiefly to the dismantling of puddling furnaces, the number having decreased from 4,853 in 1890 to approximately 3,250 in 1900. The consumption of pig iron, spiegeleisen, and ferromanganese in 1900 shows an increase of 4,563,375 tons compared with 1890, or 78 per cent, and of 8,048,977 tons compared with 1880, or 340.9 per cent. Old iron and steel rails and other scrap iron and steel show a large increase in consumption in 1900 compared with 1890 and 1880, the increase over the former year amounting to 2,387,125 tons and over the latter year to 2,914,445 tons. Purchased hammered iron-ore blooms, pig and scrap blooms, imported Swedish billets and bars, and muck or scrap bar show a decrease in consumption in 1900 compared with 1890. On the other hand, the consumption of purchased ingots, blooms, billets, tin-plate bars, sheet bars, and slabs shows a very great increase in 1900 compared with both 1890 and 1880, this increase, compared with 1890, amounting to 2,807,889 tons, and compared with 1880 to 3,613,525 tons. The consumption of purchased wire rods was not separately reported in 1890 or 1880.

The great increase shown in the cost reported for all other materials in 1900 is explained in part by the inclusion of all freight charges not reported in the cost given for the individual items named in the table. For the reasons already stated, no comparisons of cost for individual items in 1900 can be made with the cost reported for 1890 and 1880.

### FUEL CONSUMED.

The principal fuel consumed in 1900 by rolling mills and steel works was bituminous coal and slack, the increased consumption over 1890 amounting to 6,326,991 tons, and over 1880 to 6,831,824 tons. In the consumption of anthracite coal and culm the increase in 1900 over 1890 amounted to only 85,947 tons, and over 1880 to 312,789 tons. Coke shows an increased consumption in 1900 over 1890 of 476,308 tons, and over 1880 of 699,920 tons. Charcoal, which is largely used by rolling mills which manufacture iron blooms for their own consumption, shows a decrease in 1900 as compared with both 1890 and 1880, the falling off being very slight. The consumption of oil for fuel in 1900 shows a decrease of 556,523 barrels compared with 1890. No report of the quantity of oil consumed as fuel in the manufacture of iron and steel in 1880 seems to have been made.

There were 13 states in 1900 which used anthracite coal or culm in the manufacture of steel or of rolled iron and steel, as follows: Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, Ohio, Indiana, Illinois, Michigan, and Missouri. Indiana reports a consumption of 1 ton only, Illinois 14 tons, Michigan 20 tons, and Missouri 6 tons. The chief consuming states were Pennsylvania, Ohio, New Jersey, and New York, in the order named; with the single exception of Connecticut, no other state reports a consumption of over 5,000 tons. The consumption in Pennsylvania amounted to over three-fourths of the quantity reported for the whole country.

Pennsylvania consumed considerably over one-half of the bituminous coal and slack reported in 1900, Ohio almost one-fifth, and Illinois over one-tenth. These three states consumed over 9,000,000 tons out of a total consumption of 10,944,046 tons. No other state reported a consumption of over 240,000 tons. All the producing states in 1900 reported the use of bituminous coal or slack, except Oregon.

The use of coke as fuel in 1900 was reported by rolling mills and steel works in 22 states. Five states, namely, Maine, Rhode Island, Kansas, Oregon, and Washington, did not report the use of this fuel. The leading consuming states were Pennsylvania, Ohio, Illinois, and West Virginia. In the remainder of the country the consumption was very small, not amounting to over 16,000 tons in any single state.

The use of charcoal was reported by 12 states in 1900 which made steel or which rolled iron or steel, namely, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Kentucky, Tennessee, Ohio, Illinois, Wisconsin, and Missouri. Pennsylvania and Massachusetts were the leading consumers, no other state reporting the use of over 75,000 bushels.

The use of oil as fuel in 1900 by rolling mills and steel works was reported by 17 states, the leading consumer being Illinois. Wisconsin was second, Pennsylvania third, California fourth, New Jersey fifth, and Ohio sixth. No other state reported the consumption of over 25,000 barrels. Oregon was the only state which in 1900 reported the use of fuel oil only.

The cost of natural gas used as fuel by rolling mills and steel works in 1900 amounted to $3,098,409, compared with $3,566,946 in 1890, a loss of $468,537. The figures for 1890 do not, however, represent the actual value of the natural gas consumed in that year, as a number of iron and steel plants in Indiana and Ohio were furnished with free gas in return for establishing works in the cities or towns which controlled the gas supply. This fuel was used as early as 1874 in puddling furnaces in Pennsylvania, but its use in the manufacture of iron and steel did not become general until 1883 and subsequent years. In the census year 1880 it was used by very few rolling mills and steel works, but in 1890 its use was reported by 85 establishments of this character, of which 68 were in Pennsylvania—54 in Allegheny county and 14 in the western part of the state outside of Allegheny county—8 were in Ohio, 5 were in West Virginia, and 4 were in Indiana.

In 1900 the number of establishments which reported the use of natural gas, either in whole or in part, was 92, of which 61 were located in Pennsylvania, 5 in West Virginia, 8 in Ohio, 1 in Kentucky, and 17 in Indiana. The 61 establishments in Pennsylvania were located in the following counties: Allegheny, 36; Westmoreland, 10; Armstrong and Washington, 4 each; Lawrence, 2; and Beaver, Crawford, Delaware, Indiana, and Venango, 1 each. Of the 5 West Virginia plants, all were located in or near Wheeling, 4 being in Ohio county and 1 in Marshall county. The 8 Ohio plants were located in 6 counties—3 in Belmont, and 1 each in Allen, Franklin, Lawrence, Miami, and Tuscarawas counties. The single Kentucky establishment was located in Boyd county, and the 17 Indiana establishments in 7 counties, namely, Madison, 6; Delaware, 4; Grant, 3; and Blackford, Hamilton, Henry, and Miami counties, 1 each.

In the census report for 1890 a table giving the consumption of bituminous coal in the states which also reported the use of natural gas in the manufacture of steel and of rolled iron and steel appeared. Table 49 is a comparative summary showing the consumption of bituminous coal, 1880 to 1900, by the states which used natural gas. with the cost of the latter fuel in 1890 and 1900.

TABLE 49.—ROLLING MILLS AND STEEL WORKS: BITUMINOUS COAL CONSUMED IN STATES IN WHICH NATURAL GAS IS USED, 1880 TO 1900.

| STATES. | CONSUMPTION OF BITUMINOUS COAL AND SLACK (TONS[1]). | | | COST OF NATURAL GAS CONSUMED. | |
|---|---|---|---|---|---|
| | 1900 | 1890 | 1880 | 1900 | 1890 |
| Pennsylvania | 5,927,016 | 1,542,324 | 1,977,624 | $2,607,904 | $3,391,468 |
| Ohio | 2,033,469 | 1,303,109 | 603,646 | 128,496 | 151,403 |
| Indiana | 178,185 | 116,094 | 134,015 | 282,852 | [2] |
| West Virginia | 238,922 | 158,369 | 143,920 | 75,729 | 24,075 |
| Kentucky | 160,517 | 93,039 | 94,186 | 3,428 | [3] |

[1] Gross ton of 2,240 pounds. [2] Supplied free. [3] None reported.

Pennsylvania consumed much the larger part of the natural gas reported in both 1900 and 1890. The consumption of bituminous coal in this state shows a considerable decrease in 1890 compared with 1880, but a large increase in 1900 compared with 1890. Increases in the consumption of bituminous coal in 1900 compared with 1890 are also shown in all natural gas consuming states. While the number of rolling mills and steel works which consumed natural gas for fuel in whole or in part in 1900 shows an increase of 7 all told, compared with ten years ago, Pennsylvania shows a loss of 7 establishments from 1890 to 1900, the gain in establishments in the whole country being confined to Indiana, which reported an increase of 13 establishments in 1900 over 1890. In addition Kentucky appears as a consumer of natural gas for the first time in any census year, 1 establishment in that state reporting its use in 1900. Ohio and West Virginia report exactly the same number of establishments in 1900 as ten years ago. From these details it will be seen that the use of natural gas by rolling mills and steel works is not increasing. Compared with ten years ago a few additional establishments may use this fuel, but as a rule these establishments also consume bituminous coal or producer gas, the supply of natural gas not being sufficient for use in all departments of the works.

### PRODUCTS.

Table 50 shows the quantity and value of the leading products reported by rolling mills and steel works in 1900, 1890, and 1880. While steel castings are included for each of the years named, the quantity and value are reported separately for 1900 only. Steel ingots, when made for sale, are included. Gross tons of 2,240 pounds are used.

TABLE 50.—ROLLING MILLS AND STEEL WORKS; QUANTITY AND VALUE OF PRODUCTS, 1880 TO 1900.

| CLASSES. | 1900 | | 1890 | | 1880 | |
|---|---|---|---|---|---|---|
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| Total | ..... | $596,689,284 | ..... | $331,860,872 | ..... | $203,274,042 |
| Rails: | | | | | | |
| Iron | 880 | 31,180 | 13,715 | 622,224 | 416,890 | 20,978,697 |
| Steel | 2,250,457 | 46,501,979 | 1,853,862 | 60,272,575 | 670,161 | 37,892,075 |
| Iron and steel bars and rods, not including sheet or tin-plate bars or wire rods | 2,493,159 | 100,597,221 | 1,572,347 | 68,567,415 | 874,144 | 56,696,679 |
| Iron and steel wire rods | 916,587 | 35,529,529 | [2] | [2] | [2] | [2] |
| Structural shapes: | | | | | | |
| Iron | 27,091 | 1,051,556 | 122,792 | 6,941,474 | 86,438 | 5,520,719 |
| Bessemer steel | 263,800 | 8,381,717 | 85,440 | 4,529,411 | 497 | 63,060 |
| Open-hearth steel | 566,092 | 19,928,249 | 68,123 | 3,992,074 | 71 | 8,800 |
| Iron and steel hoops, bands, cotton ties, and skelp | 1,195,189 | 49,159,747 | [3]546,203 | [3]23,628,849 | [3]201,039 | [3]13,979,893 |
| Iron and steel rolled car axles | 56,339 | 2,757,051 | 2,232 | 127,500 | 2,348 | 179,154 |
| Iron and steel hammered car axles | 46,267 | 1,725,886 | 52,184 | 2,935,451 | 19,589 | 1,000,104 |
| Iron and steel muck and scrap bar produced for sale | 203,681 | 5,940,587 | 252,089 | 7,411,748 | 57,562 | 2,440,941 |
| Iron and steel boiler and other plates and sheets, except nail and tack plate, black plates or sheets for tinning, and armor plate | 1,488,066 | 68,109,223 | 652,693 | 39,359,094 | 262,063 | 22,432,202 |
| Iron and steel nail plate | 81,101 | 2,466,340 | [2] | [2] | [2] | [2] |
| Iron and steel tack plate | 16,563 | 650,218 | [2] | [2] | [2] | [2] |
| Black plates or sheets for tinning: | | | | | | |
| Bessemer steel | 355,077 | 18,673,312 | [2] | [2] | [2] | [2] |
| Open-hearth steel | 38,937 | 2,294,494 | [2] | [2] | [2] | [2] |
| Iron and steel armor plate and gun forgings | 15,302 | 7,526,479 | [2] | [2] | [2] | [2] |
| Iron and steel rolled blooms, slabs, billets, tin-plate bars, and sheet bars produced for sale | 4,172,286 | 96,321,887 | [2] | [2] | [2] | [2] |
| Ingots produced for sale | 103,707 | 2,781,145 | [2] | [2] | [2] | [2] |
| Direct steel castings | 177,156 | 14,609,893 | [2] | [2] | [2] | [2] |
| All other products | ..... | 111,651,591 | ..... | 113,473,057 | ..... | 41,461,718 |

[1] Gross ton of 2,240 pounds. [2] Not reported separately. [3] Hoops and skelp only.

As shown by Table 51 the total production of iron and steel by rolling mills and steel works in 1900 was 15,040,129 tons, compared with 7,388,244 tons in 1890 and 3,046,038 tons in 1880. The production of the various forms of iron and steel which constitute a large part of this total is given in Table 50.

### IRON AND STEEL RAILS.

The total production of iron and steel rails in 1900, not including old steel rails renewed for owners by rail mills, was 2,251,337 tons, of which 2,250,457 tons were Bessemer or open-hearth steel rails and 880 tons were iron rails. The open-hearth rails made did not exceed 1,500 tons. In 1890 the total rail production was 1,867,577 tons, of which 13,715 tons were iron and 1,853,862 tons were Bessemer steel, no open-hearth steel rails being made. In 1880 the total rail production was 1,087,051 tons, of which 416,890 tons were iron and 670,161 tons were steel, open-hearth steel contributing to the latter total 8,129 tons.

As will be seen from these details, the manufacture of iron rails in the United States had almost entirely ceased in 1900. The few tons made were chiefly for use in mines and were of light weight. The average price of iron rails in 1900 was $35.43 per ton; in 1890 it was $45.36 per ton; and in 1880 it was $50.32 per ton.

The production of steel rails in 1900 shows an increase of 396,595 tons over 1890, or 21.4 per cent, and of 1,580,296 tons over 1880, or 235.8 per cent. The average price of steel rails in 1900 was $20.66 per ton, compared with $32.51 per ton in 1890 and $56.54 per ton in 1880.

In 1900 there were 15 establishments which produced steel rails, as follows: Pennsylvania, 6; Maryland, 2; Ohio, 3; Tennessee, 1; Illinois, 1; Wisconsin, 1; and Colorado, 1. In addition, 2 establishments, 1 in Illinois and 1 in Kansas, renewed 28,717 tons of Bessemer steel rails—that is, old or worn out steel rails were re-rolled at a certain rate per ton. The amount received by these 2 establishments for work of this character is not included in the value of the rails reported for 1900. It is, however, included under custom work and repairing. Over one-half of the steel rails reported in 1900 were produced in Pennsylvania, its output amounting to 1,218,158 tons, valued at $24,593,612. Illinois ranked second, its production amounting to 567,398 tons. Maryland ranked third, turning out 185,737 tons, and Ohio ranked fourth, reporting 142,918 tons. No other state produced over 85,000 tons. The open-hearth rails were made in Pennsylvania. The 880 tons of iron rails reported were made in Pennsylvania, Tennessee, Ohio, and Wyoming.

For many years rails weighing 56 pounds to the yard were the standard size, but the increased weight of locomotives and passenger and freight cars in recent years, together with the high speed at which trains of all kinds are now run, necessitated the use of rails of heavier section. Accordingly, 80-pound, 85-pound, 90-pound, and 100-pound rails were demanded by the railroad companies, and rails of these weights are now in use on all the leading trunk lines. The weight per yard of the rails rolled during the census year was not definitely ascertained, but from data at hand it is possible to give a close approximation of the production of light and heavy sections.

All the iron rails made were of light section, weighing less than 45 pounds to the yard. Of the 2,250,457 tons of steel rails produced, about 150,000 tons weighed less than 45 pounds to the yard, about 1,500,000 tons weighed over 45 but less than 85 pounds to the yard, and the remainder, a little over 600,000 tons, weighed 85 pounds and over to the yard. About two-thirds of the open-hearth steel rails weighed less than 45 pounds to the yard, and about one-third over 45 pounds but less than 85 pounds. Statistics recently published by the American Iron and Steel Association for the calendar year 1901 show a decrease compared with 1900 in the production of rails weighing over 85 pounds to the yard, but a decided increase in those weighing less than 85 but over 45 pounds to the yard.

### BARS AND RODS.

During 1900 there were produced 2,493,159 tons of iron and steel bars and rods, not including wire rods (details for which are given separately for 1900), compared with 1,572,347 tons in 1890 and 874,144 tons in 1880. The increase in 1900 compared with 1890 was 920,812 tons, or 58.6 per cent, and compared with 1880 it was 1,619,015 tons, or 185.2 per cent. The average price of these bars and rods was $40.35 per ton in 1900, $43.61 in 1890, and $64.86 in 1880. In the figures given for bars and rods in 1890, and possibly for 1880 as well, only the quantity and value of the bars and rods made for sale appear, the quantity and value consumed by the producing works in the manufacture of bolts, nuts, rivets, etc., being included as a rule under "all other products." In 1900, however, the total quantity and value of the bars and rods produced were ascertained, only the increased value given to these bars and rods when forged into various articles appearing under "all other products." The tonnage reported for bars and rods for 1890 and perhaps for 1880 is, therefore, considerably less than the actual quantity made. The value reported is also much less than the true value.

Twenty-four out of the 27 states which operated rolling mills or steel works in 1900 report bars and rods, the three states not so reporting being Maryland, West Virginia, and Kansas. Pennsylvania was far in the lead of all other states in the quantity and value of bars and rods made, this state producing 1,036,759 tons, valued at $43,453,494, or an average value per ton of $41.91. Ohio made 472,159 tons, valued at $17,787,412, or an average value per ton of $37.67; Illinois, 197,190 tons, valued at $6,374,298, or an average per ton of $32.33; Indiana, 191,606 tons, valued at $7,754,600, or an average per ton of $40.47; and Wisconsin, 115,952 tons, valued at $3,731,171, or an average of $32.18 per ton. These 5 states produced all told 2,013,666 tons of bars and rods, or over 80.8 per cent of the production of the whole country. None of the other producing states made over 100,000 tons.

### WIRE RODS.

Separate statistics for iron and steel wire rods were not collected in 1890 or 1880, the tonnage and value being included in "all other products." In 1900, as shown in Table 50, the production was 916,587 tons, valued at $35,529,529, or an average value per ton of $38.76. Nine states reported wire rods in 1900 as follows, the states being arranged in the order of their prominence as producers: Pennsylvania, Ohio, Illinois, Massachusetts, Kentucky, New Jersey, Indiana, Con-

necticut, and New York. In Pennsylvania the production was 276,395 tons, the value $11,240,537, and the average value per ton $40.67, and in Ohio it was 241,250 tons, valued at $9,863,704, an average value per ton of $40.89. Outside of Illinois and Massachusetts, which produced 226,050 and 106,279 tons, respectively, no other state made over 25,000 tons.

### STRUCTURAL SHAPES.

The increasing use of iron and steel in late years in the construction of large office buildings, bridges, steel cars, etc., is forcibly shown by comparing the production of structural shapes in 1900 with 1890 and 1880. In 1900 the total production of iron, Bessemer steel, and open-hearth steel material for structural purposes was 856,983 tons, against 276,355 tons in 1890, an increase of 580,628 tons, or 210.1 per cent, and 87,006 tons in 1880, an increase of 769,977 tons, or 885 per cent. Steel has largely supplanted iron for work of this character since 1880, when almost all the structural shapes reported were made of the latter metal. As shown in the table, the falling off in 1900 in the production of iron structural shapes as compared with 1890 amounted to 95,701 tons, or 77.9 per cent, and as compared with 1880 to 59,347 tons, or 68.7 per cent, the figures for 1890 showing a growth as compared with 1880. Bessemer structural shapes show an increase in 1900 as compared with 1890 of 178,360 tons, or 208.8 per cent, and as compared with 1880 of 263,303 tons. Open-hearth structural shapes increased in 1900 over 1890 by 497,969 tons, or 731 per cent, and over 1880 by 566,021 tons.

The average value per ton of iron structural shapes in 1900 was $38.82, as compared with $56.53 in 1890 and $63.87 in 1880; of Bessemer-steel structural shapes $31.77 in 1900, $53.01 in 1890, and $126.88 in 1880; and of open-hearth structural shapes $35.20 in 1900, $58.60 in 1890, and $123.94 in 1880. For all kinds of structural shapes (including iron and Bessemer and open-hearth steel) the average value in 1900 was $34.26 per ton, against $55.95 in 1890 and $64.28 in 1880.

In 1900 the iron structural shapes were produced in Pennsylvania, California, and New Jersey, in the order named; the Bessemer-steel shapes in Pennsylvania, Ohio, New York, Colorado, and Illinois, in the order named; and the open-hearth shapes in Pennsylvania and New Jersey. Pennsylvania's production of all kinds of structural shapes in 1900 amounted to 766,995 tons, valued at $25,578,658 (average per ton, $33.35). Of the total production 15,445 tons, valued at $617,915, were iron (average per ton, $40.01); 225,458 tons, valued at $7,032,494, were Bessemer steel (average per ton, $31.19); and 526,092 tons, valued at $17,928,249, were open-hearth steel (average per ton, $34.08). New Jersey produced 45,300 tons of iron and open-hearth shapes. No other state reported a production of 35,000 tons. Pennsylvania produced 57 per cent of all the iron shapes, 85.5 per cent of the Bessemer-steel shapes, and 92. 9 per cent of the open-hearth steel shapes reported for 1900. Its percentage of the grand total was 89.5. Almost all the open-hearth shapes reported by this state in 1900 were made of basic steel.

### HOOPS, BANDS, COTTON TIES, AND SKELP.

Iron and steel hoops, bands, cotton ties, and skelp were made in 1900 in 6 states, as follows, in the order of their prominence: Pennsylvania, West Virginia, Ohio, Illinois, Connecticut, and New York. In the censuses for 1890 and 1880 bands and cotton ties were apparently included with "all other products." No comparisons for either of the years named are, therefore, made with the tonnage and value reported for 1900.

The production of hoops, bands, cotton ties, and skelp in 1900 amounted to 1,195,189 gross tons, valued at $49,159,747, or an average value per ton of $41.13. Of the total reported Pennsylvania contributed 828,050 tons, valued at $35,398,558, or an average value per ton of $42.75; West Virginia, 158,843 tons, valued at $6,282,700, or an average value per ton of $39.55; Ohio, 128,188 tons, valued at $4,452,276, or an average value of $34.73 per ton; and Illinois, 61,008 tons, valued at $2,100,198, or an average value of $34.42 per ton. The total production of the two remaining states amounted to less than 20,000 tons.

### ROLLED AND HAMMERED CAR AXLES.

In 1900 two states only (Pennsylvania and New Jersey) made rolled car axles, their combined production amounting to 56,339 tons, valued at $2,757,051, or an average value per ton of $48.94. In 1890 the average value of the 2,232 tons made was $57.12 per ton, and in 1880 the average value per ton was $76.30, 2,348 tons being produced. Almost all the rolled car axles made in 1900 were reported by Pennsylvania.

Iron and steel hammered car axles were reported by rolling mills located in 6 states in 1900, as follows, the states being arranged in the order of their prominence: Pennsylvania, Missouri, Michigan, Virginia, Alabama, and Delaware. The production of Pennsylvania was 26,636 tons, valued at $911,698, or an average value per ton of $34.23, and of Missouri 8,018 tons, valued at $344,891, or an average value per ton of $43.01. The combined production of the remaining states amounted to less than 12,000 tons.

The average value per ton of the hammered car axles reported in 1900 was $37.30, as compared with $56.25 in 1890 and $81.89 in 1880. The production of 1900 shows a loss of 5,917 tons as compared with 1890, but a gain of 26,728 tons as compared with 1880.

### MUCK AND SCRAP BAR PRODUCED FOR SALE.

A number of rolling mills make a specialty of the manufacture of muck bar and iron and steel scrap bar

for sale. Other establishments which make muck and scrap bar consume a part of their output in the manufacture of more highly finished forms and sell the remainder in the open market. The details given in Table 50 relate only to the quantity and value of the muck and scrap bar made for sale. The quantity and value of the muck and scrap bar consumed by the producing works are, of course, included in the various finished rolled or hammered forms reported by the different establishments.

In 1900 there were 9 states which produced muck or scrap bar for sale, namely, Pennsylvania, Ohio, Indiana, West Virginia, New Jersey, Illinois, Virginia, Maine, and Kentucky. Outside of Pennsylvania, Ohio, Indiana, New Jersey, and West Virginia the quantity made for sale was very small, amounting all told to about 1,000 tons. The average value of the muck and scrap bar produced for sale in Pennsylvania in 1900 was $29.32 per ton, in Ohio $27.95 per ton, in New Jersey $31.68 per ton, and in West Virginia $26.11 per ton.

Compared with 1890, the production in 1900 of muck and scrap bar for sale shows a loss of 48,408 tons, or 19.2 per cent, but compared with 1880 a gain is shown of 146,119 tons, or 253.8 per cent. The average price per ton in 1900 was $29.16, compared with $29.40 in 1890 and $42.41 in 1880.

### PLATES AND SHEETS, EXCEPT NAIL AND TACK PLATE, BLACK PLATES FOR TINNING, AND ARMOR PLATE.

There were 11 states in 1900 which reported the manufacture of iron and steel boiler and other plates and sheets, their total production amounting to 1,488,066 tons, valued at $68,109,223. In these figures, nail and tack plate, black plates or sheets for tinning, and armor plate are not included.

Of the total given above, Pennsylvania reported 1,067,269 tons, valued at $47,561,014, or an average value per ton of $44.56; Ohio, 236,931 tons, valued at $12,359,818, or an average value of $52.17 per ton; Illinois, 81,497 tons, valued at $2,515,793, or an average value of $30.87 per ton; and Indiana, 36,696 tons, valued at $1,921,938, or an average value of $52.37 per ton. The other producing states, in the order of their prominence, were Kentucky, West Virginia, Delaware, Alabama, Colorado, New Jersey, and Maryland, their combined production amounting to less than 66,000 tons.

The production of plates and sheets, with the exceptions noted above, increased 835,373 tons in 1900 compared with 1890 and 1,226,003 tons compared with 1880. The average value per ton in 1900 was $45.77, against $60.30 in 1890 and $85.60 in 1880.

### NAIL AND TACK PLATE.

Statistics for nail plate were not collected in the censuses of 1890 or 1880, details for cut nails only being given. Tack plate was included with "all other products."

The manufacture of nail plate was reported in 1900 by 8 states, the total production amounting to 81,101 tons, valued at $2,466,340, or $30.41 per ton. To this total Pennsylvania contributed 40,805 tons, valued at $1,020,665, and Ohio 16,094 tons, valued at $680,644. The other states reporting, were Massachusetts, West Virginia, Kentucky, Illinois, California, and Virginia. The combined production of these 6 states amounted to only 24,202 tons, valued at $765,031. Details concerning the production and value of cut nails will be found in a later table.

Tack plate was reported by 4 states in 1900, the quantity produced amounting to 16,563 tons, valued at $650,218. Massachusetts ranked first, West Virginia second, Pennsylvania third, and California fourth, the production of Massachusetts amounting to over one-half of the total tonnage reported.

### BLACK PLATES OR SHEETS FOR TINNING.

Full and complete details concerning the manufacture of black plates and sheets for tinning in 1900 will be found in a special report on the manufacture of Tin and Terne Plates issued by the Twelfth Census. A few facts relating to the production of black plates in the census year are given below. This branch of the iron and steel industry dates from the inauguration of the manufacture of tin and terne plates in this country in 1890, few plates of this character having been made in the United States prior to the passage of the tariff act of 1890.

Eight states were engaged in 1900 in the production of black plates or sheets for tinning, namely: Pennsylvania, Indiana, Ohio, West Virginia, Missouri, Illinois, Maryland, and Kentucky. The total production amounted to 394,014 tons, valued at $20,967,806. Of this total 355,077 tons, valued at $18,673,312, were Bessemer steel, and 38,937 tons, valued at $2,294,494, were open-hearth steel. The average value per ton of Bessemer steel plates was $52.59, and of open-hearth steel plates $58.93. Combining the two grades, the average value per ton was $53.22.

The Bessemer plates were reported by Pennsylvania, Indiana, Ohio, West Virginia, Illinois, Maryland, and Kentucky, and the open-hearth plates by Missouri, Pennsylvania, Illinois, Ohio, and Indiana, all the states being arranged in the order of their prominence. Pennsylvania produced 169,464 tons of Bessemer plates, valued at $9,012,437, or an average value per ton of $53.18; Indiana, Ohio, and West Virginia produced 172,132 tons, valued at $8,920,878, or an average value of $51.83 per ton. The production of the remaining states amounted to 13,481 tons of Bessemer plates, valued at $739,997, or an average value per ton of $54.89. Missouri produced the largest quantity of open-hearth plates, Pennsylvania ranked second, Illinois third, Ohio fourth, and Indiana fifth. The average value per ton of the plates produced in Missouri was $65; in Pennsylvania, $45.17; in Illinois, $67.20; and in Ohio and Indiana, $50.63.

### STEEL ARMOR PLATE AND GUN FORGINGS.

The production of steel armor plate and gun forgings during the census year 1900 amounted to 15,302 tons, valued at $7,526,479, or an average value per ton of $491.86. The total production was reported by the state of Pennsylvania. Homogeneous steel armor plate was first made in the United States in 1890, at Bethlehem, Pa. In 1891 steel armor plate was also produced at Pittsburg, Pa. American armor plate, which enjoys a world-wide reputation for its many points of excellence, is now manufactured by immense hydraulic presses, at least one of which has an energy of 15,000 tons. A few years ago the plates were formed into shape by heavy rolls or were forged under hammers. The thickness of the plate varies from 3 to 18 inches for Harvey armor and from 3 to 12 inches for Krupp armor. The dimensions of the heaviest plate ever made in this country, which was used on the port turret of the war ship *Wisconsin*, of the United States Navy, are as follows: Finished weight, 112,586 pounds; length, 249½ inches; width, 135 inches; thickness, 14 inches. This plate was made in 1898 at South Bethlehem, Pa. During the same year a barbette plate for the war ship *Alabama* was produced at the same place. It weighed 104,340 pounds, was 15 inches thick, 239 inches long, and 104¾ inches wide. The heaviest side armor plate ever made in the United States was produced at Pittsburg, Pa., in 1895, and weighed when finished 97,520 pounds. It was used on the United States war ship *Oregon*. This plate was 255 inches long, 90 inches wide, and 18 inches thick.

### STEEL INGOTS PRODUCED FOR SALE.

In 1900 eight states reported the production of Bessemer and open-hearth steel ingots for sale, as follows: Pennsylvania, Illinois, West Virginia, Minnesota, New York, Michigan, Indiana, and Colorado. Some of these ingots were sold to establishments engaged in the manufacture of heavy forgings, and were, therefore, finished under hammers. Much the larger part, however, was manufactured into slabs, blooms, billets, bars, and other partly finished or completely finished forms by rolling mills.

Pennsylvania reported a production of 84,498 tons of ingots for sale in 1900, valued at $2,459,693, or an average value of $29.11 per ton; Illinois and West Virginia, 11,904 tons, valued at $206,816, or an average of $17.37 per ton; Minnesota, 3,361 tons, valued at $50,415, or an average per ton of $15. The production by the other states named above was 3,944 tons, valued at $64,221, or $16.28 per ton. Both Bessemer and open-hearth ingots were reported, but the production of each kind was not separately ascertained.

### DIRECT STEEL CASTINGS.

The production of direct steel castings in 1900 amounted to 177,156 tons, valued at $14,609,893, or an average value per ton of $82.47. Complete details concerning the manufacture of castings of this character will be found in subsequent tables.

### MISCELLANEOUS ROLLED PRODUCTS.

The production of various forms of rolled iron and steel not heretofore enumerated amounted in 1900 to 506,880 tons, valued at $19,202,606, the average value of these miscellaneous products being $37.88 per ton. Included in the total are splice bars, fish plates, flats, rolled blanks suitable for drawing into seamless tubes, strip steel, socket iron and steel, etc. Pennsylvania produced 356,761 tons of miscellaneous forms of rolled iron and steel in 1900; Ohio, 29,761 tons; Virginia, 24,288 tons; Wisconsin, 17,601 tons; Illinois, 16,353 tons; New Jersey, 14,015 tons; New York, 11,969 tons; Michigan, 10,000 tons; Missouri, 8,378 tons; Wyoming, 6,080 tons; Indiana, 5,153 tons; Colorado, 4,000 tons; Maryland, 2,454 tons; and Tennessee, 67 tons.

### MISCELLANEOUS FORGED PRODUCTS.

In addition to the hammered car axles, gun forgings, and armor plate above reported, a number of rolling mills and steel works turn out annually a considerable quantity of finished light and heavy forgings. In 1900 there were 8 states in which the rolling mills and steel works reported the manufacture of shafting, piston rods, connecting rods, cranks, machinery, and marine, steamboat, railroad, and other forgings. The total production of this class of materials in 1900 amounted to 65,512 tons, valued at $6,148,134, or an average value per ton of $93.85. The producing states were Pennsylvania, 45,626 tons; Illinois, 9,547 tons; Ohio, 4,360 tons; New York, 3,133 tons; Connecticut, 1,208 tons; Missouri, 755 tons; Massachusetts, 547 tons; and Maryland, 336 tons.

### TOTAL PRODUCTION OF STEEL CASTINGS AND OF ROLLED AND FORGED IRON AND STEEL, BY STATES.

Table 51 shows the total production of all kinds of rolled and forged iron and steel by rolling mills and steel works in 1900, 1890, and 1880, by states. Direct steel castings are included. So, too, are steel ingots when produced for sale.

TABLE 51.—ROLLING MILLS AND STEEL WORKS: QUANTITIES OF PRODUCTS, BY STATES, 1880 TO 1900.

| STATES. | 1900 (Tons.)[1] | 1890 (Tons.)[1] | 1880 (Tons.)[1] |
|---|---|---|---|
| United States | 15,040,129 | 7,388,244 | 3,046,038 |
| Alabama | 100,318 | 46,612 | 580 |
| California | 25,419 | 50,667 | 12,500 |
| Colorado | 119,972 | 18,646 | 4,018 |
| Connecticut | 43,908 | 24,756 | 17,216 |
| Delaware | 53,025 | 52,176 | 30,284 |
| District of Columbia | ..... | ..... | 236 |
| Georgia | ..... | 2,534 | 10,269 |
| Illinois | 1,485,346 | 813,079 | 287,946 |
| Indiana | 425,946 | 98,394 | 69,536 |
| Iowa | ..... | 1,056 | ..... |
| Kansas | (2) | ..... | 17,013 |
| Kentucky | 129,309 | 43,823 | 58,610 |
| Maine | 2,750 | 9,196 | 7,903 |
| Maryland | 223,306 | 18,055 | 42,508 |
| Massachusetts | 137,502 | 134,483 | 117,620 |
| Michigan | 80,483 | 36,239 | 20,652 |
| Minnesota | 13,259 | 2,290 | ..... |
| Missouri | 59,026 | 24,739 | 23,846 |
| Nebraska | ..... | ..... | 1,786 |
| New Hampshire | ..... | 5,988 | 7,123 |
| New Jersey | 142,152 | 140,425 | 73,765 |
| New York | 137,981 | 214,310 | 226,084 |
| Ohio | 2,737,497 | 1,007,154 | 340,562 |
| Oregon | 4,505 | ..... | ..... |
| Pennsylvania | 8,503,852 | 4,259,800 | 1,483,736 |
| Rhode Island | 5,618 | 11,613 | 7,262 |
| Tennessee | 13,400 | 18,438 | 25,112 |
| Vermont | ..... | ..... | 5,357 |
| Virginia | 40,943 | 46,823 | 31,407 |
| Washington | 5,000 | ..... | ..... |
| West Virginia | 352,814 | 231,998 | 60,212 |
| Wisconsin | 187,376 | 66,692 | 54,154 |
| Wyoming | 9,422 | 8,308 | 8,741 |

[1] Gross ton of 2,240 pounds.
[2] The single rolling mill in this state was active in 1900, but was engaged exclusively on custom work.

As stated heretofore, the production of all kinds of materials by rolling mills and steel works in 1900 increased 7,651,885 tons compared with 1890 and 11,994,091 tons compared with 1880.

Pennsylvania made 56.5 per cent of the total production in 1900, compared with 57.7 per cent in 1890 and 48.7 per cent in 1880; Ohio made 18.2 per cent in 1900, 13.6 per cent in 1890, and 11.2 per cent in 1880; Illinois made 9.9 per cent in 1900, 11 per cent in 1890, and 9.5 per cent in 1880; Indiana made 2.8 per cent in 1900, 1.3 per cent in 1890, and 2.3 per cent in 1880; West Virginia made 2.3 per cent in 1900, 3.1 per cent in 1890, and 2 per cent in 1880; and Maryland made 1.5 per cent in 1900, 0.2 per cent in 1890, and 1.4 per cent in 1880. No other state made over 1.3 per cent of the total product in 1900.

In 1900 Pennsylvania increased its production over 1890 by 4,244,052 tons, or 99.6 per cent, and over 1880 by 7,020,116 tons, or 473.1 per cent. Ohio increased its production in 1900 over 1890 by 1,730,343 tons, or 171.8 per cent, and over 1880 by 2,396,935 tons, or 703.8 per cent. In Illinois the increase in 1900 over 1890 was 672,267 tons, or 82.7 per cent, and over 1880 it was 1,197,400 tons, or 415.8 per cent. Indiana shows an increase of 327,552 tons, or 332.9 per cent, in 1900 over 1890, and of 356,410 tons, or 512.6 per cent, over 1880. In West Virginia the increase in 1900 over 1890 amounted to 120,816 tons, or 52.1 per cent, and over 1880 to 292,602 tons, or 486 per cent. In Maryland the production, which had fallen from 42,508 tons in 1880 to 18,055 tons in 1890, increased over tenfold in the decade from 1890 to 1900. The increase in this state was due almost entirely to the starting of a large steel-rail plant at Sparrows Point in 1891.

Comparing the production of 1900 with 1890, it is found that 6 states, namely, Maine, Rhode Island, New York, Virginia, Tennessee, and California, report a smaller production in the former year than in the latter year. The falling off in New York was especially marked, the production in 1880 in this state being much larger than in 1900. The decrease in the twenty years amounted to 88,103 tons, or 39 per cent. Maine also shows a smaller production in 1900 as compared with 1880, but this decrease was caused by the destruction by fire of its single active establishment soon after the opening of the census year, and by its enforced idleness until shortly after the close of the census period. Had this establishment been in continuous operation Maine would probably have shown a fair growth in production as compared with both 1890 and 1880. Kansas does not appear as a producer in 1900, although its single rolling mill was in operation in that year. It was engaged, however, exclusively on custom work and repairing.

### PRODUCTION OF IRON AND STEEL CUT AND WIRE NAILS.

In the census report for 1890 a table giving the total production of iron and steel cut and wire nails in the United States in 1880 and 1890 appeared. For comparative purposes this table is repeated below, the details for 1900 being added.

TABLE 52.—PRODUCTION OF IRON AND STEEL CUT NAILS AND WIRE NAILS: 1880, 1890, AND 1900.

| KINDS. | KEGS OF 100 POUNDS. | | |
|---|---|---|---|
| | 1900 | 1890 | 1880 |
| Total | 9,079,345 | 8,750,346 | 5,056,600 |
| Iron, combined iron and steel, and steel cut nails | 1,689,143 | 5,857,030 | 5,056,600 |
| Iron and steel wire nails | 7,390,202 | 2,893,316 | (1) |

[1] Not reported.

In 1880 and 1890, and in 1900 as well, almost all the iron and steel cut nails made were reported by establishments which rolled their own nail plate. On the other hand, out of the 49 establishments which reported iron and steel wire nails in 1890, only 9 rolled the rods and drew the wire from which the nails were made, the remaining 40 establishments purchasing either the rods or wire. These 9 establishments reported in 1890 a total production of 1,142,927 kegs of 100 pounds, while the 40 establishments reported a production of 1,750,389 kegs. Of the total production, all but 1,040 kegs were made from steel wire. In 1880 steel wire

nails were not made in commercial quantities in the United States, and for that year they do not therefore appear in the table. It was not until 1883 or 1884 that wire nails came prominently into the market as a competitor of cut nails. Steel cut nails were not made until about 1883. Combined iron and steel cut nails were made in the same year.

In 1900, 11 establishments which rolled rods and drew wire reported a production of 4,603,010 kegs of iron and steel wire nails, and 48 establishments which made wire nails from purchased wire, or drew wire from purchased rods for use in their own nail factories, reported a production of 2,787,192 kegs; the total production was therefore 7,390,202 kegs. Of the establishments which rolled their own rods, 1 was located in Massachusetts, 6 in Pennsylvania, 3 in Ohio, and 1 in Indiana. Of those which produced nails from purchased wire or from wire drawn from purchased wire rods, 4 were located in Massachusetts, 1 in Rhode Island, 2 in Connecticut, 5 in New York, 6 in Pennsylvania, 1 in Maryland, 1 in West Virginia, 4 in Ohio, 2 in Indiana, 14 in Illinois, 1 in Michigan, 4 in Wisconsin, 1 in Kansas, 1 in Washington, and 1 in California.

In 1900 there were 23 establishments which reported the manufacture of iron and steel cut nails, the total production amounting to 1,689,143 kegs. Of these establishments, 19 rolled the nail plate consumed in their nail factories and 4 purchased the plate from which the nails reported were cut. The former establishments, which produced all told 1,658,443 kegs, were located as follows: Massachusetts, 2; New Jersey, 1; Pennsylvania, 8; Virginia, 1; West Virginia, 2; Kentucky, 1; Ohio, 3; and Illinois, 1. The establishments which made nails from purchased plate produced in all 30,700 kegs. They were located as follows: Maryland, 1; Indiana, 1; and Illinois, 2.

The decline in the cut-nail industry has been quite rapid since the calendar year 1886, when, according to the reports of the American Iron and Steel Association, the maximum production of 8,160,973 kegs was reached. According to the same authority there has been a further decline in production since the close of the census year, 1900, the output in the calendar year 1901 amounting to only 1,542,240 kegs, or 282,509 kegs less than were produced in 1856, when 1,824,749 kegs were made. Of the production in 1901, 1,509,248 kegs were made by 18 establishments which rolled their own nail plate, and 32,992 kegs by 6 establishments which purchased from rolling mills the nail plate used in their cut-nail factories.

Wire nails, on the other hand, show a strong and steady growth during the last fifteen years. In 1886 the estimated production of 27 establishments was 600,000 kegs;[1] in 1890, as shown in the table, the production amounted to 2,893,316 kegs, and in 1900 to 7,390,202 kegs, an increase over 1890 of 4,496,886 kegs, or 155.4 per cent. In the calendar year 1901 the output, according to the association above named, was 9,803,822 kegs, or almost six and one-half times the production of cut nails in the same year. This large production was reported by 61 works, of which 18 made the rods and drew the wire from which the nails were made and 43 purchased the necessary materials either in the form of wire or in the form of rods, establishments of the latter class drawing these purchased rods into wire in their own plants. The value at works of the iron and steel cut nails produced in 1900 was approximately $2 per keg. Of the wire nails it was about $2.70 per keg.

### IRON AND STEEL WIRE.

The quantity and value of the iron and steel wire reported by rolling mills and steel works in 1900 amounted to 579,595 tons, valued at $35,283,688, or an average value per gross ton of $60.87. The rolling mills which drew wire were located in 7 states, as follows: Pennsylvania, Ohio, Massachusetts, New Jersey, Illinois, Indiana, and Connecticut. Pennsylvania produced 230,839 tons, valued at $12,980,134, or an average value per ton of $56.23; Ohio produced 181,462 tons, valued at $10,386,098, or $57.24 per ton; Massachusetts, 77,731 tons, valued at $5,829,825, or $75 per ton; New Jersey, 27,873 tons, valued at $2,457,429, or $88.17 per ton; Illinois, 27,467 tons, valued at $1,508,822, or $54.93 per ton; Indiana, 24,623 tons, valued at $1,401,380, or $56.91 per ton; and Connecticut, 9,600 tons, valued at $720,000, or $75 per ton.

The wire statistics given above do not by any means represent the total quantity and value of the iron and steel wire produced in the United States during the census year 1900, as the output only of those establishments which drew wire as well as rolled iron or steel in that year is included. During 1900 at least 50 establishments manufactured wire from purchased rods. Neither the production nor the value of this wire is included in the figures given.

[1] Publications of the American Iron and Steel Association.

## STEEL INGOTS AND STEEL CASTINGS.

In the tables which follow the production and value of all kinds of steel ingots and direct steel castings for the census year 1900 are given in detail. Comparative statistics of steel production for 1900, 1890, and 1880 will be given later.

### PRODUCTION OF BESSEMER STEEL INGOTS AND CASTINGS.

Bessemer steel is made from pig iron taken in a molten state from cupolas or from blast furnaces and run into a converter. Air is then blown through the metal,

usually under high pressure, the oxidizing influence of the air eliminating the carbon and silicon from the molten iron. Spiegeleisen or ferromanganese, containing known percentages of both carbon and manganese, are introduced into the converters while the metal is in a molten state, the desired percentage of carbon thus being restored. The effect of the manganese is to liberate the oxygen which has been injected into the molten mass by the blast.

Bessemer steel was first produced in the United States in commercial quantities in 1867. For many years thereafter it was used almost exclusively for the manufacture of rails. In 1880 there were, all told, 11 Bessemer steel establishments in this country, all of which were built for the manufacture of steel rails, the Bessemer converters in many cases having been added to works which had previously been engaged in the production of iron rails. Over 75 per cent of the Bessemer ingots produced in 1880 were converted into steel rails. The 11 establishments were located in 5 states, namely, New York, Pennsylvania, Ohio, Illinois, and Missouri. Ten years later, in 1890, the number of Bessemer steel establishments (including works equipped for the manufacture of Clapp-Griffiths and Robert-Bessemer steel, both of which are modifications of the standard Bessemer process) had increased to 51, located in 11 states, namely, Massachusetts, New York, Pennsylvania, Virginia, West Virginia, Ohio, Illinois, Indiana, Michigan, Missouri, and Colorado. Steel rails still consumed the larger part of the ingots made, about 51 per cent of the ingots produced in 1890 having been used for their manufacture.

Since 1880 at least four modifications of the standard Bessemer process have been introduced into the United States, namely, the Clapp-Griffiths process from England in 1884, the Robert-Bessemer process from France in 1888, the Walrand-Legenisel process, also from France, in 1895, and the Tropenas process from England in 1898. As in the standard Bessemer process the molten metal is decarbonized and desiliconized by the use of air in all the processes named, the modifications existing in the converters and in the manner in which the air is blown through or across the metal.

As a rule the Clapp-Griffiths converters ranged in capacity from two to three gross tons. The Robert-Bessemer and the Tropenas process are each used in this country solely for the manufacture of steel castings. The capacity of the Robert-Bessemer converters ranges from 1½ to 2 tons and that of the Tropenas converters from 1 to 2 tons at each blow.

Clapp-Griffiths steel was first produced in the United States at Pittsburg, Pa., on March 25, 1884. In 1890 there were 6 establishments which were equipped with converters for the production of steel by this process, 4 of which were in operation, their total production amounting to 69,314 gross tons. In 1900 all of these plants had been abandoned except 1 establishment in Massachusetts with 1 converter, and this converter was idle.

Robert-Bessemer steel was first produced in this country experimentally at Springfield, Ohio, in September, 1888. In 1890 there were 5 completed plants which were equipped with converters for the manufacture of steel by this process and 1 plant was in course of construction. The production of Robert-Bessemer steel, principally in the form of castings, amounted to 4,361 gross tons in 1890. In 1900 the number of Robert-Bessemer plants had decreased to 1, which was equipped with 2 converters. All the plants reported in 1890, with the exception of the one just mentioned, had been abandoned or dismantled in the intervening ten years. The production of Robert-Bessemer steel in 1900, all in the form of direct castings, amounted to 2,300 tons.

Walrand-Legenisel steel was first produced in this country in a small converter at East Chicago, Ind., in 1895, steel castings only being made. In 1896 this converter, which had a capacity of 1,000 pounds, was removed to Chicago, Ill., where it was put in operation in the same year, its output still being confined to steel castings. It ran for a short time only, and was dismantled in 1897.

Tropenas steel was first produced in the United States at Derby, Conn., in May, 1898. In 1900 there were 5 establishments which were equipped for the manufacture of steel by this process. The production of 3 of these establishments amounted to 747 tons, all in the form of steel castings. In addition two establishments (one in Connecticut and one in California) operated Tropenas converters in 1900 and made about 150 tons of castings. These establishments also produced other products, which exceeded in value the steel castings made. As in census compilations establishments are classified according to the articles of chief value produced, the 150 tons of steel castings above mentioned are not included in the steel statistics given in Table 53. If this product be added to the 747 tons above reported, a total of 897 tons of Tropenas castings is reached for the census year 1900.

Table 53 shows the production and value by states of the Bessemer steel ingots and castings produced in the United States in the census year 1900; also the number of active and idle establishments and the number of active and idle converters for the same year.

TABLE 53.—BESSEMER STEEL WORKS: EQUIPMENT, CAPACITY, AND PRODUCTION, BY STATES, 1900.

| STATES. | NUMBER OF ESTABLISHMENTS. | | | CONVERTERS. | | | | INGOTS AND CASTINGS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Active. | | Idle. | | Total. | | Ingots. | | Castings. | |
| | Total. | Active. | Idle. | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| United States | 42 | 33 | 9 | 70 | 34,925 | 21 | 3,495 | 7,532,028 | $132,113,984 | 7,528,267 | $131,791,519 | 3,761 | $322,465 |
| California,[2] Colorado, and Illinois | 5 | 5 | ..... | 11 | 5,657 | ..... | ..... | 1,340,421 | 17,195,086 | 1,339,788 | 17,160,401 | 633 | 34,685 |
| Connecticut[3] | 1 | 1 | ..... | 1 | 8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Indiana, Kentucky, and Maryland | 4 | 2 | 2 | 4 | 2,500 | 4 | 830 | 326,057 | 5,425,461 | 326,057 | 5,425,461 | ..... | ..... |
| Massachusetts | 1 | ..... | 1 | ..... | ..... | 1 | 100 | ..... | ..... | ..... | ..... | ..... | ..... |
| Michigan, Minnesota, and Wisconsin[4] | 4 | 3 | 1 | 5 | 50 | 2 | 300 | 3,000 | 278,500 | ..... | ..... | 3,000 | 278,500 |
| New York | 1 | ..... | 1 | ..... | ..... | 3 | 665 | ..... | ..... | ..... | ..... | ..... | ..... |
| Ohio | 6 | 6 | ..... | 12 | 7,578 | ..... | ..... | 1,697,353 | 32,773,262 | 1,697,353 | 32,773,262 | ..... | ..... |
| Pennsylvania | 17 | 14 | 3 | 33 | 17,977 | 9 | 1,400 | 3,911,127 | 71,197,603 | 3,911,049 | 71,188,323 | 78 | 9,280 |
| Virginia and West Virginia | 3 | 2 | 1 | 4 | 1,160 | 2 | 200 | 254,070 | 5,244,072 | 254,070 | 5,244,072 | ..... | ..... |

[1] Gross ton of 2,240 pounds.
[2] The quantity and value of the steel produced in California is included in the products reported by shipbuilding establishments.
[3] The quantity and value of Bessemer steel produced by 1 establishment in Connecticut is included in the products reported by establishments engaged in the manufacture of ordnance and ordnance stores.
[4] One idle Bessemer steel plant in Wisconsin is connected with an establishment which produces cast-iron pipe.

Of the 42 establishments which contained Bessemer converters in 1900, 33 were active and 9 were idle. These 42 establishments were equipped with 91 converters, of which 70 were active during that year and 21 were idle. The total daily capacity of the 91 converters was 38,420 tons, of which the active establishments reported 34,925 tons and the idle establishments 3,495 tons. Allowing 300 working days, this would give an annual capacity of 11,526,000 tons. Of the 42 establishments reported, 35 were equipped for the manufacture of standard Bessemer steel, 1 for the manufacture of Clapp-Griffiths steel, 1 for the manufacture of Robert-Bessemer steel, and 5 for the manufacture of Tropenas steel. Of the 35 standard Bessemer plants, 32 were equipped for the manufacture of steel by the acid process and 3 for the manufacture of steel by the basic process. The 32 acid plants were equipped with 72 converters and the 3 basic plants with 8 converters. The Clapp-Griffiths plant was equipped with 1 converter, the 5 Tropenas plants with 8 converters, and the single Robert-Bessemer plant with 2 converters.

Attention was called in the census report for 1890 to the increase in the capacity of the standard Bessemer converters in use in that year as compared with those in use in 1880, the usual capacity in the year last named having been 5 tons, while in the year first named converters of 10 to 12 tons were in use. Since 1890 the capacity of the converters at a number of Bessemer plants has been further increased to 15 tons, while at 1 establishment 20-ton converters have been installed.

Sixteen states report plants equipped with Bessemer converters in 1900, but in only 12 of these states were these converters in operation, Massachusetts, New York, Virginia, and Indiana all reporting idle Bessemer plants. Of the 12 producing states, 3 report the manufacture of ingots and castings, 4 the manufacture of ingots only, and 5 the manufacture of castings only.

The total production of Bessemer steel ingots and castings amounted in 1900 to 7,532,028 tons, valued at $132,113,984. Of the total, 7,528,267 tons, valued at $131,791,519, or $17.51 per ton, were ingots, and 3,761 tons, valued at $322,465, or $85.74 per ton, were castings.

Pennsylvania made 51.9 per cent of the total production of Bessemer steel ingots and castings in 1900, Ohio 22.5 per cent, and Illinois 16.1 per cent. These 3 states made 90.5 per cent of the total output. No other state produced as much as 3.5 per cent.

Michigan produced 61.2 per cent of the total output of Bessemer steel castings. No other state made 18 per cent. The average value of the steel ingots produced by Pennsylvania was $18.20 per ton; by Ohio, $19.31 per ton; by Illinois, $12.43 per ton; and by the remaining states, $18.02 per ton.

Table 54 shows the number of active converters, the quantity of steel castings made, and the value of these castings for Robert-Bessemer and Tropenas plants for the year 1900. No idle converters were reported, and no ingots were made by either of the processes named. The single idle Clapp-Griffiths converter in existence in 1900 is not included in the table.

TABLE 54.—ROBERT-BESSEMER AND TROPENAS STEEL WORKS: EQUIPMENT, CAPACITY, AND PRODUCTION, BY STATES, 1900.

| STATES. | Number of establishments. | ACTIVE CONVERTERS. | | CASTINGS. | |
|---|---|---|---|---|---|
| | | Number. | Daily capacity, tons.[1] | Tons.[1] | Value. |
| United States | 6 | 10 | 115 | 3,047 | $283,974 |
| Connecticut | [2]1 | 1 | 8 | 3,047 | 283,974 |
| California | [2]1 | 1 | 7 | | |
| Illinois | 1 | 3 | 50 | | |
| Michigan | 1 | 2 | 10 | | |
| Minnesota | 1 | 1 | 10 | | |
| Wisconsin | 1 | 2 | 30 | | |

[1] Gross ton of 2,240 pounds.
[2] Included also with establishments classified as "ordnance and ordnance stores."
[3] Included also with establishments engaged in shipbuilding.

In addition to the tonnage given above, 1 establishment in Connecticut produced 89 tons of Tropenas castings. This tonnage (and the value thereof) has been included in the report for establishments engaged in the manufacture of ordnance and ordnance stores. One establishment in California also produced a small quantity of Tropenas castings, but neither the tonnage nor value of these castings is included in the table, both items having been included in the report for the iron and steel shipbuilding industry.

Of the total value of the Robert-Bessemer and Tropenas steel castings reported for 1900 Michigan contributed 75.5 per cent and Wisconsin, 21.3 per cent. No other state contributed as much as 1.7 per cent.

### PRODUCTION OF OPEN-HEARTH STEEL INGOTS AND CASTINGS.

Open-hearth steel is usually made in a regenerative furnace, lined with fire brick and having an acid or a basic bottom. A mixture of pig iron and steel scrap, or other highly refined material, is melted to the desired condition. It is then tapped into a ladle, a certain quantity of spiegeleisen or ferromanganese being added either in the furnace or ladle in order that the desired percentage of carbon may be obtained. From the ladle the steel is run into ingots or direct castings. The melted mass, prior to the addition of spiegeleisen or ferromanganese, is termed the bath. Artificial or natural gas, highly heated, is used to melt the pig iron and scrap. In the open-hearth furnaces the percentage of carbon can be readily regulated. In an acid furnace the slag contains usually 45 per cent of silica and upwards, while in a basic furnace the slag as a rule contains less than 20 per cent of silica.

Open-hearth steel was first produced in the United States at Trenton, N. J., in December, 1868, the construction of a furnace having been commenced in the spring of the year named. This pioneer enterprise was not a commercial success, and it was abandoned after about two years of experimental work. A considerable quantity of steel was made, but as a rule it could only be rolled at an extremely high temperature. The furnace had a melting capacity of about 4 or 5 tons at each heat.

The second plant to manufacture open-hearth steel in the United States was erected at South Boston, Mass., in 1869–70, the first steel being made early in the latter year. The enterprise was a commercial success from the start, the steel produced being of good quality. It was at first largely used for the manufacture of iron rails with steel tops or heads, the steel welding with the iron perfectly. Subsequently the manufacture of steel-headed rails was discontinued. The steel was then rolled into plates, which were used for boiler and fire-box purposes. This furnace had a capacity at each melt of 5 tons. It was operated, night and day, for several years.

In 1871 the erection of a 5-ton furnace was commenced at Nashua, N. H. It was completed and put in operation in 1872. Forgings for marine and railroad use were largely made. Boiler and fire-box plates were also produced, and, later, locomotive and car-wheel tires.

In 1871 or 1872 an open-hearth furnace of about 5 tons capacity was erected at Pittsburg, Pa. It was put in operation about the same time as the Nashua enterprise. Mild steel was made in considerable quantities, and was used in the manufacture of plates for boilers, fire boxes, etc. All the works named above used the acid process. Other establishments were shortly erected in different sections of the country, but, as will be shown later on, the growth of the open-hearth steel industry in the United States was not rapid until after the basic process had been firmly established.

Basic open-hearth steel was first commercially produced in the United States in 1886, at Cleveland, Ohio, although steel by the basic process had been made experimentally in a Bessemer converter at Steelton, Pa., in the spring of 1884. In 1888 basic open-hearth steel was also manufactured commercially at Homestead, Pa. In the census year 1900, as will be presently shown, over 70 per cent of the open-hearth steel made in the United States was produced by the basic process. In 1890, however, only a very small percentage of the total production was made by this process.

In 1880 the melting capacity of the open-hearth furnaces was from 7 to 10 tons per heat. In 1890 the size had increased considerably, a number of plants having furnaces with a melting capacity of from 20 to 30 tons. In 1900 the size had still further increased, a large number of plants being equipped with 50-ton furnaces, and at least one plant with a 75-ton furnace.

The production of open-hearth steel ingots and castings in the United States in the census year 1900 by the acid and basic processes amounted to 3,044,356 tons, as compared with 480,035 tons in 1890 and 75,269 tons in 1880, an increase in 1900 over 1890 of 2,564,321 tons, or 534.2 per cent, and over 1880 of 2,969,087 tons, or 3,944.6 per cent. The average value per ton of the open-hearth steel made in 1900 was $23.60.

Table 55 shows the production and value of acid and basic open-hearth steel ingots and castings in 1900 by states; also the number of active and idle establishments and the number of active and idle furnaces for the same year.

TABLE 55.—OPEN-HEARTH STEEL WORKS: NUMBER OF ESTABLISHMENTS AND FURNACES, AND PRODUCTION AND VALUE OF ACID AND BASIC INGOTS AND CASTINGS, BY STATES, 1900.

| STATES. | NUMBER OF ESTABLISHMENTS. | | | NUMBER OF FURNACES. | | | INGOTS AND CASTINGS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Total. | | Acid. | | Basic. | |
| | Total. | Active. | Idle. | Total. | Active. | Idle. | Gross tons. | Value. | Gross tons. | Value. | Gross tons. | Value. |
| United States | 96 | 82 | 14 | 331 | 307 | 24 | 3,044,356 | $71,855,172 | 890,521 | $28,345,666 | 2,153,835 | $43,509,506 |
| Connecticut and Massachusetts | 4 | 4 | ..... | 11 | 11 | ..... | 52,354 | 2,354,503 | 36,074 | 1,727,623 | 16,280 | 626,880 |
| New Jersey and New York | 10 | 6 | 4 | 21 | 15 | 6 | 64,283 | 2,729,880 | 39,783 | 2,094,880 | 24,500 | 635,000 |
| Illinois | 6 | 5 | 1 | 26 | 24 | 2 | 249,313 | 6,026,723 | 34,442 | 1,150,400 | 214,871 | 4,876,323 |
| Alabama, Kentucky, Maryland, and Tennessee | 7 | 4 | 3 | 20 | 14 | 6 | 50,535 | 1,001,406 | 2,344 | 61,905 | 48,191 | 939,501 |
| Ohio | 8 | 8 | ..... | 29 | 27 | 2 | 114,926 | 3,459,900 | 52,532 | 2,126,080 | 62,394 | 1,333,820 |
| Indiana | 5 | 5 | ..... | 8 | 8 | ..... | 51,953 | 1,441,837 | 30,818 | 1,010,612 | 21,135 | 431,225 |
| Pennsylvania | 49 | 45 | 4 | 205 | 199 | 6 | 2,437,918 | 53,639,364 | 691,396 | 20,011,086 | 1,746,522 | 33,628,278 |
| Michigan, Minnesota, Missouri, and Wisconsin | 7 | 5 | 2 | 11 | 9 | 2 | 23,074 | 1,201,559 | 3,132 | 163,080 | 19,942 | 1,038,479 |

Fifteen states made open-hearth steel in 1900, as compared with 10 in 1890 and 9 in 1880. In 1900 Pennsylvania produced 80.1 per cent of the total output of the whole country, Illinois 8.2 per cent, and Ohio 3.8 per cent, these 3 states making 92.1 per cent of the total production. No other state made over 1.8 per cent.

Acid-open-hearth steel was produced in 12 states in 1900. Of the total output Pennsylvania contributed 77.6 per cent, Ohio 5.9 per cent, Massachusetts 4 per cent, Illinois 3.9 per cent, Indiana 3.5 per cent, and New Jersey 3.4 per cent. The production of no other state exceeded 1.2 per cent. The average value per ton of the acid open-hearth steel ingots and castings made in 1900 was $31.83.

Basic open-hearth steel was produced in 10 states in 1900. Pennsylvania was far in the lead of all other states, its output amounting to 81.1 per cent of the total production. Illinois was second, producing 10 per cent, and Ohio was third, its production amounting, however, to only 2.9 per cent. Alabama ranked fourth, its production amounting to 2.2 per cent. No other state made over 1 per cent. The average value per ton of the basic open-hearth ingots and castings produced in 1900 was $20.20.

The number of active and idle establishments in 1900 which were equipped for the manufacture of acid or basic open-hearth steel, or both, was 96, of which 82 were active during the census year and 14 were idle. The 82 active establishments had, all told, 307 furnaces, of which 139 were acid and 168 were basic. The 14 idle establishments had 13 acid furnaces and 11 basic furnaces. In addition, at the close of the census year, 14 establishments were erecting 43 open-hearth furnaces, 11 to manufacture steel by the acid and 32 by the basic process. The 11 acid furnaces were being erected in the following states: Delaware, 1; Massachusetts, 2; Missouri, 1; Ohio, 2; and Pennsylvania, 5. The 32 basic furnaces were being constructed in the states named: Alabama, 1; Delaware, 4; Illinois, 4; Indiana, 2; Kentucky, 3; Missouri, 2; Ohio, 1; and Pennsylvania, 15. The 3 furnaces in Kentucky were partly erected prior to the opening of the census year, and work upon them stopped; they were not completed at the close of the census year.

Of the 82 active open-hearth establishments reported for 1900, 46 produced acid steel only, 19 produced basic steel only, and 17 produced both acid and basic steel. In 1900 the number of open-hearth establishments which produced ingots only was 38; castings only, 32; and both ingots and castings, 12.

Table 56 shows the production and value of acid and basic open-hearth steel ingots and castings separately by states.

TABLE 56.—OPEN-HEARTH STEEL WORKS: PRODUCTION AND VALUE OF ACID AND BASIC INGOTS AND CASTINGS, BY STATES, 1900.

| STATES. | Number of producing establishments. | ACID AND BASIC. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total. | | Ingots. | | Castings. | |
| | | Gross tons. | Value. | Gross tons. | Value. | Gross tons. | Value. |
| United States | 82 | 3,044,356 | $71,855,172 | 2,878,827 | $58,850,581 | 165,529 | $13,004,591 |
| Connecticut and Massachusetts | 4 | 52,354 | 2,354,503 | 44,844 | 1,769,440 | 7,510 | 585,063 |
| New York, New Jersey, and Maryland | [1]7 | 66,533 | 2,786,130 | 49,750 | 1,269,250 | 16,783 | 1,516,880 |
| Alabama and Tennessee | 3 | 48,285 | 945,156 | 48,191 | 939,501 | 94 | 5,655 |
| Illinois and Indiana | 10 | 301,266 | 7,468,560 | 256,859 | 4,352,997 | 44,407 | 3,115,563 |
| Michigan, Minnesota, Missouri, and Wisconsin | 5 | 23,074 | 1,201,559 | 12,617 | 382,179 | 10,457 | 819,380 |
| Ohio | 8 | 114,926 | 3,459,900 | 96,824 | 2,049,162 | 18,102 | 1,410,738 |
| Pennsylvania | [2]45 | 2,437,918 | 53,639,364 | 2,369,742 | 48,088,052 | 68,176 | 5,551,312 |

[1] Includes 1 establishment in New York which was operated experimentally, but which did not produce steel commercially.
[2] Includes 1 active establishment, the products of which are reported with establishments classed as "foundry and machine shop products."

TABLE 56.—OPEN-HEARTH STEEL WORKS: PRODUCTION AND VALUE OF ACID AND BASIC INGOTS AND CASTINGS, BY STATES, 1900—Continued.

| STATES. | Number of producing establishments. | ACID. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total. | | Ingots. | | Castings. | |
| | | Gross tons. | Value. | Gross tons. | Value. | Gross tons. | Value. |
| United States | 82 | 890,521 | $28,345,666 | 761,516 | $17,969,322 | 129,005 | $10,376,344 |
| Connecticut and Massachusetts | 4 | 36,074 | 1,727,623 | 28,564 | 1,142,560 | 7,510 | 585,063 |
| New York, New Jersey, and Maryland | [1]7 | 42,033 | 2,151,130 | 25,250 | 634,250 | 16,783 | 1,516,880 |
| Alabama and Tennessee | 3 | 94 | 5,655 | ..... | ..... | 94 | 5,655 |
| Illinois and Indiana | 10 | 65,260 | 2,161,012 | 44,423 | 800,232 | 20,837 | 1,360,780 |
| Michigan, Minnesota, Missouri, and Wisconsin | 5 | 3,132 | 163,080 | 2,275 | 63,700 | 857 | 99,380 |
| Ohio | 8 | 52,532 | 2,126,080 | 34,430 | 715,342 | 18,102 | 1,410,738 |
| Pennsylvania | [2]45 | 691,396 | 20,011,086 | 626,574 | 14,613,288 | 64,822 | 5,397,848 |

| STATES. | Number of producing establishments. | BASIC. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total. | | Ingots. | | Castings. | |
| | | Gross tons. | Value. | Gross tons. | Value. | Gross tons. | Value. |
| United States | 82 | 2,153,835 | $43,509,506 | 2,117,311 | $40,881,259 | 36,524 | $2,628,247 |
| Connecticut and Massachusetts | 4 | 16,280 | 626,880 | 16,280 | 626,880 | ..... | ..... |
| New York, New Jersey, and Maryland | [1]7 | 24,500 | 635,000 | 24,500 | 635,000 | ..... | ..... |
| Alabama and Tennessee | 3 | 48,191 | 939,501 | 48,191 | 939,501 | ..... | ..... |
| Illinois and Indiana | 10 | 236,006 | 5,307,548 | 212,436 | 3,552,765 | 23,570 | 1,754,783 |
| Michigan, Minnesota, Missouri, and Wisconsin | 5 | 19,942 | 1,038,479 | 10,342 | 318,479 | 9,600 | 720,000 |
| Ohio | 8 | 62,394 | 1,333,820 | 62,394 | 1,333,820 | ..... | ..... |
| Pennsylvania | [2]45 | 1,746,522 | 33,628,278 | 1,743,168 | 33,474,814 | 3,354 | 153,464 |

[1] Includes 1 establishment in New York which was operated experimentally, but which did not produce steel commercially.
[2] Includes 1 active establishment, the products of which are reported with establishments classed as "foundry and machine shop products."

Eleven states in 1900 produced either acid or basic open-hearth ingots and 11 states likewise produced either acid or basic castings. Four states which produced ingots did not report castings, and 4 states which produced castings did not make ingots.

Of the total production of acid and basic open-hearth steel in 1900, 94.6 per cent was ingots and 5.4 per cent was castings. The average value of the ingots was $20.44 per ton and of the castings $78.56 per ton. Pennsylvania reported an average value per ton of $20.30 for ingots; Ohio, $21.16; Illinois, $16.25; Alabama, $19.50; Indiana, $20.19; Massachusetts, $39.46; and New Jersey, $25.07. These states are the leading manufacturers of open-hearth steel.

Acid open-hearth ingots or castings were made in 12 states in 1900, 6 states reporting ingots and castings, 2 states ingots only, and 4 states castings only. Of the total production, 85.5 per cent was ingots and 14.5 per cent was castings. Of the acid ingots reported, Pennsylvania made 82.3 per cent, the average value per ton being $23.52; Ohio made 4.5 per cent, the average value per ton being $20.78; Massachusetts made 3.8 per cent—average value per ton, $40; Indiana made 3.2 per cent—average value per ton, $20; and New Jersey made 3 per cent—average value per ton, $25.13. None of the other producing states made over 2.6 per cent.

Ten states made basic open-hearth ingots or castings in 1900. Of this number 7 states reported ingots only, 2 states both ingots and castings, and 1 state castings only. Of the total production 98.3 per cent was ingots and 1.7 per cent was castings. Pennsylvania made 82.3 per cent of the ingots, the average value per ton being $19.21; Illinois made 9 per cent—average value per ton, $16.32; and Ohio made 2.9 per cent—average value per ton, $21.38. These 3 states made 94.3 per cent of the total production. Alabama made 2.3 per cent, the average value per ton being $19.50; Indiana, 1 per cent—average value per ton, $20.40, and New Jersey, 0.9 per cent—average value per ton, $25. No other state produced over 0.8 per cent.

Table 57 shows the number and daily capacity of the active and idle acid and basic open-hearth furnaces in 1900, by states.

TABLE 57.—OPEN-HEARTH STEEL WORKS: NUMBER AND DAILY CAPACITY OF ACTIVE AND IDLE ACID AND BASIC FURNACES, BY STATES, 1900.

| STATES. | Number of establishments. | ACID AND BASIC FURNACES. | | | | | | ACID FURNACES. | | | | | | BASIC FURNACES. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AGGREGATE. | | TOTAL ACTIVE. | | TOTAL IDLE. | | Total. | | Active. | | Idle. | | Total. | | Active. | | Idle. | |
| | | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] | Number. | Daily capacity, tons.[1] |
| United States .. | 96 | 331 | 19,030 | 307 | 18,245 | 24 | 785 | 152 | 6,419 | 139 | 6,094 | 13 | 325 | 179 | 12,611 | 168 | 12,151 | 11 | 460 |
| Alabama | 3 | 13 | 1,150 | 12 | 1,120 | 1 | 30 | ..... | ..... | ..... | ..... | ..... | ..... | 13 | 1,150 | 12 | 1,120 | 1 | 30 |
| Connecticut | 1 | 1 | 10 | 1 | 10 | ..... | ..... | 1 | 10 | 1 | 10 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Illinois | 6 | 26 | 1,578 | 24 | 1,498 | 2 | 80 | 6 | 303 | 4 | 223 | 2 | 80 | 20 | 1,275 | 20 | 1,275 | ..... | ..... |
| Indiana | 5 | 8 | 333 | 8 | 333 | ..... | ..... | 5 | 203 | 5 | 203 | ..... | ..... | 3 | 130 | 3 | 130 | ..... | ..... |
| Kentucky | 2 | 5 | 214 | ..... | ..... | 5 | 214 | 1 | 14 | ..... | ..... | 1 | 14 | 4 | 200 | ..... | ..... | 4 | 200 |
| Maryland | 1 | 1 | 30 | 1 | 30 | ..... | ..... | 1 | 30 | 1 | 30 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Massachusetts | 3 | 10 | 576 | 10 | 576 | ..... | ..... | 8 | 440 | 8 | 440 | ..... | ..... | 2 | 136 | 2 | 136 | ..... | ..... |
| Michigan | 1 | 1 | 30 | 1 | 30 | ..... | ..... | 1 | 30 | 1 | 30 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Minnesota | 2 | 4 | 140 | 3 | 100 | 1 | 40 | 1 | 40 | ..... | ..... | 1 | 40 | 3 | 100 | 3 | 100 | ..... | ..... |
| Missouri | 1 | 3 | 42 | 3 | 42 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 3 | 42 | 3 | 42 | ..... | ..... |
| New Jersey | 4 | 9 | 335 | 7 | 310 | 2 | 25 | 6 | 225 | 5 | 210 | 1 | 15 | 3 | 110 | 2 | 100 | 1 | 10 |
| New York | 6 | 12 | 350 | 8 | 190 | 4 | 160 | 7 | 126 | 5 | 86 | 2 | 40 | 5 | 224 | 3 | 104 | 2 | 120 |
| Ohio | 8 | 29 | 1,272 | 27 | 1,218 | 2 | 54 | 15 | 532 | 13 | 478 | 2 | 54 | 14 | 740 | 14 | 740 | ..... | ..... |
| Pennsylvania | 49 | 205 | 12,925 | 199 | 12,745 | 6 | 180 | 96 | 4,421 | 93 | 4,341 | 3 | 80 | 109 | 8,504 | 106 | 8,404 | 3 | 100 |
| Tennessee | 1 | 1 | 6 | 1 | 6 | ..... | ..... | 1 | 6 | 1 | 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Wisconsin | 3 | 3 | 39 | 2 | 37 | 1 | 2 | 3 | 39 | 2 | 37 | 1 | 2 | ..... | ..... | ..... | ..... | ..... | ..... |

[1] Gross ton of 2,240 pounds.

Table 57 shows that while Pennsylvania had a little less than two-thirds of the total number of open-hearth furnaces in 1900, it had more than two-thirds of the total capacity reported for the whole country. Ohio was next in order in the number of furnaces, but it ranked third in capacity, Illinois reporting 3 less furnaces but 306 tons more capacity. Alabama ranked fourth in the number of furnaces and Massachusetts fifth.

In the number and capacity of acid furnaces Pennsylvania ranked first, Ohio second, and Massachusetts third. Illinois ranked fourth in capacity but fifth in the number of furnaces, New York reporting 1 more furnace but a much smaller capacity. In the number and capacity of basic furnaces Pennsylvania was first and Illinois second. Ohio was third in the number of furnaces but fourth in capacity, Alabama reporting 1 furnace less but a considerably greater capacity.

Table 58 shows the production and value of open-hearth steel castings by the acid and basic processes by states.

TABLE 58.—OPEN-HEARTH STEEL WORKS: PRODUCTION AND VALUE OF ACID AND BASIC CASTINGS, BY STATES, 1900.

| STATES. | Number of producing establishments. | Number of establishments making acid castings. | Number of establishments making basic castings. | CASTINGS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total. | | Acid. | | Basic. | |
| | | | | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| United States | [2] 44 | 40 | 5 | 165,529 | $13,004,591 | 129,005 | $10,376,344 | 36,524 | $2,628,247 |
| Connecticut, Massachusetts, and New Jersey | 4 | 4 | ..... | 14,422 | 1,196,943 | 14,422 | 1,196,943 | ..... | ..... |
| Illinois and Missouri | [2] 5 | 3 | 3 | 47,831 | 3,317,791 | 14,661 | 843,008 | 33,170 | 2,474,783 |
| Indiana | 3 | 3 | ..... | 6,176 | 517,772 | 6,176 | 517,772 | ..... | ..... |
| New York, Tennessee, and Wisconsin | 5 | 5 | ..... | 10,822 | 1,010,035 | 10,822 | 1,010,035 | ..... | ..... |
| Ohio | 4 | 4 | ..... | 18,102 | 1,410,738 | 18,102 | 1,410,738 | ..... | ..... |
| Pennsylvania | 23 | 21 | 2 | 68,176 | 5,551,812 | 64,822 | 5,397,848 | 3,354 | 153,464 |

[1] Gross ton of 2,240 pounds. [2] One establishment in Illinois makes both acid and basic castings. It therefore appears in both the acid and basic columns.

Of the 44 open-hearth establishments which produced steel castings in 1900 there were 39 which made acid castings only, 4 which made basic castings only, and 1 which made both acid and basic castings. The establishments which produced steel castings only were equipped with 51 acid and 9 basic furnaces.

The average value per ton of the acid and basic open-hearth castings made in 1900 was $78.56. Pennsylvania produced 41.2 per cent of the total output, the average value per ton being $81.43; Illinois 23.1 per cent, the average value per ton being $67.95; Ohio 10.9 per cent, the average value per ton being $77.93; New York 6 per cent, the average value per ton being $88.52, and Missouri 5.8 per cent, the average value per ton being $75. No other state produced over 4.1 per cent.

Of the acid castings reported Pennsylvania made 50.2

per cent—average value per ton $83.27; Ohio, 14 per cent—average value per ton $77.93; Illinois, 11.4 per cent—average value per ton $57.50, and New York 7.7 per cent—average value per ton $88.52. New Jersey made 5.4 per cent, Massachusetts 5.2 per cent, and Indiana 4.8 per cent of the total production. No other state made over 0.7 per cent.

The 3 states which produced basic steel castings in 1900 were Illinois, Missouri, and Pennsylvania, the state first named turning out almost two-thirds of the total production (64.5 per cent). Missouri made 26.3 per cent and Pennsylvania 9.2 per cent. The average value per ton of basic castings in Illinois was $74.45; in Missouri, $75; and in Pennsylvania, $45.76.

PRODUCTION OF CRUCIBLE STEEL INGOTS AND CASTINGS.

Crucible steel, which is produced in pots holding from 90 to 100 pounds of metal, was not successfully made in commercial quantities in the United States until 1832, when it was produced at Cincinnati, Ohio. The pots in which the steel is melted are made from plumbago, clay, and sand, and are usually filled with a mixture of charcoal and small pieces of very pure wrought iron, steel scrap, blister steel, tool scrap, etc., the mixture largely depending upon the quality of the steel desired. As a rule, from three to four hours are required to reduce the metal to the proper condition, when it is poured into ingots or castings. Crucible steel is largely used in the manufacture of tools, dies, saws, fine springs, cutlery, etc.

Table 54 shows the equipment, capacity, and production of the crucible-steel works, by states, for 1900.

In 1880 the production of crucible steel amounted to 68,037 tons, in 1890 to 73,882 tons, and in 1900 to 104,393 tons. The number of establishments in 1880 was 37, located in 9 states; in 1890, 47, located in 11 states; and in 1900, 40, located in 10 states. As shown in the table, a very small proportion of the crucible steel made in 1900 was used for the manufacture of direct castings.

TABLE 59.—CRUCIBLE STEEL WORKS: EQUIPMENT, CAPACITY, AND PRODUCTION, BY STATES, 1900.

| STATES. | NUMBER OF ESTABLISHMENTS. | | | NUMBER OF POTS THAT CAN BE USED AT A HEAT. | | | DAILY CAPACITY, TONS.[1] | | | INGOTS AND CASTINGS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Total. | | Ingots. | | Castings. | |
| | Total. | Active. | Idle. | Total. | Active. | Idle. | Total. | Active. | Idle. | Tons. | Value. | Tons. | Value. | Tons. | Value. |
| United States | 40 | 37 | 3 | 2,619 | 2,528 | 91 | 525.5 | 519.0 | 6.5 | 104,393 | $7,778,330 | 100,750 | $7,286,882 | 3,643 | $486,448 |
| Connecticut and New York | 5 | 5 | ..... | 258 | 258 | ..... | 56.0 | 56.0 | ..... | 10,256 | 949,395 | 8,582 | 723,920 | 1,674 | 225,475 |
| Maryland, Tennessee, and Ohio | 3 | 3 | ..... | 44 | 44 | ..... | 7.5 | 7.5 | ..... | 2,102 | 93,165 | 1,773 | 72,276 | 329 | 20,889 |
| Indiana, Illinois, and Wisconsin | 6 | 5 | 1 | 73 | 70 | 3 | 14.0 | 13.5 | 0.5 | 1,086 | 157,924 | ..... | ..... | 1,086 | 157,924 |
| New Jersey | 4 | 4 | ..... | 300 | 300 | ..... | 59.0 | 59.0 | ..... | 9,600 | 513,000 | 9,600 | 513,000 | ..... | ..... |
| Pennsylvania | 22 | 20 | 2 | 1,944 | 1,856 | 88 | 389.0 | 383.0 | 6.0 | 81,349 | 6,059,846 | 80,795 | 5,977,686 | 554 | 82,160 |

[1] Gross ton of 2,240 pounds.

In 1900 there were 5 states which produced crucible steel ingots and castings, 2 states which produced ingots only, and 3 states which produced castings only. The average value per ton of the ingots and castings was $74.46; of the ingots only, $72.33; and of the castings only, $133.53.

Pennsylvania made almost four-fifths of the total production of crucible steel in 1900. New Jersey and New York ranked next in production in the order named. The quantity made by the remaining states was small.

The average value of the crucible steel ingots produced in Pennsylvania was $73.99; in New Jersey, $53.44; in New York, $85.20; and in Connecticut, $78.78. The crucible castings made in 1900 were largely produced in New York, which reported 1,414 tons, the average value being $147.09 per ton. Wisconsin, which ranked second, reported an average value of $150.85 per ton, Pennsylvania an average of $148.30 per ton, and Illinois an average of $135.13 per ton.

PRODUCTION OF STEEL BY MISCELLANEOUS PROCESSES.

The production of steel in the United States by processes other than those already enumerated is not very large. During the census year 1880 the quantity made was 4,425 tons, all by Connecticut, New Jersey, and Pennsylvania. In 1890 New Jersey and Pennsylvania were the only producers, the quantity made amounting to 3,537 tons. In 1900 New Jersey and Pennsylvania were again the only states which produced steel by special processes, the output amounting to 4,223 tons. Much the larger part of this steel was made in New Jersey. All of the miscellaneous steel produced in 1900 was in the form of castings. The average value per ton was $188.58.

Table 60 shows the total production of steel by all minor processes in 1900.

TABLE 60.—PRODUCTION OF STEEL CASTINGS BY MISCELLANEOUS PROCESSES, 1900.

| STATES. | Number of establishments. | Daily capacity, gross tons. | PRODUCTION. | |
|---|---|---|---|---|
| | | | Tons.[1] | Value. |
| New Jersey | 1 | 56 | 4,223 | $796,389 |
| Pennsylvania | 2 | | | |

[1] Gross ton of 2,240 pounds.

PRODUCTION AND VALUE OF ALL KINDS OF STEEL INGOTS AND CASTINGS.

Table 61 shows the production and value of all kinds of steel ingots, by states, in 1900.

TABLE 61.—STEEL WORKS: PRODUCTION AND VALUE OF CRUDE STEEL INGOTS, BY STATES, 1900.

| STATES. | AGGREGATE. | | BESSEMER. | | OPEN-HEARTH. | | | | | | CRUCIBLE. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total. | | Acid. | | Basic. | | | |
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| United States | 10,507,844 | $197,928,982 | 7,528,267 | $131,791,519 | 2,878,827 | $58,350,581 | 761,516 | $17,969,322 | 2,117,311 | $40,881,259 | 100,750 | $7,286,882 |
| Connecticut and Massachusetts | 45,979 | 1,858,860 | ..... | ..... | 44,844 | 1,769,440 | 28,564 | 1,142,560 | 16,280 | 626,880 | 1,135 | 89,420 |
| New Jersey and New York | 64,547 | 2,360,500 | ..... | ..... | 47,500 | 1,213,000 | 23,000 | 578,000 | 24,500 | 635,000 | 17,047 | 1,147,500 |
| Maryland and West Virginia | 509,140 | 9,252,676 | 505,390 | 9,151,426 | 2,250 | 56,250 | 2,250 | 56,250 | ..... | ..... | 1,500 | 45,000 |
| Alabama, Kentucky, and Tennessee | 122,951 | 2,459,884 | 74,737 | 1,518,107 | 48,191 | 939,501 | ..... | ..... | 48,191 | 939,501 | 23 | 2,276 |
| Colorado, Michigan, and Minnesota | 141,750 | 2,491,419 | 129,133 | 2,109,240 | 12,617 | 382,179 | 2,275 | 63,700 | 10,342 | 318,479 | ..... | ..... |
| Illinois | 1,421,687 | 18,480,093 | 1,210,605 | 15,051,161 | 211,082 | 3,428,932 | 19,781 | 307,392 | 191,301 | 3,121,540 | ..... | ..... |
| Indiana | 45,777 | 924,065 | ..... | ..... | 45,777 | 924,065 | 24,642 | 492,840 | 21,135 | 431,225 | ..... | ..... |
| Ohio | 1,794,427 | 34,847,424 | 1,697,358 | 32,773,262 | 96,824 | 2,049,162 | 31,430 | 715,342 | 62,394 | 1,333,820 | 250 | 25,000 |
| Pennsylvania | 6,361,586 | 125,254,061 | 3,911,049 | 71,188,323 | 2,369,742 | 48,088,052 | 626,574 | 14,613,238 | 1,743,168 | 33,474,814 | 80,795 | 5,977,686 |

[1] Gross ton of 2,240 pounds.

Of the production of all kinds of steel ingots in 1900 71.6 per cent was Bessemer, 27.4 per cent was open hearth, and 1 per cent was crucible. No ingots were made by any minor process. The contribution of Pennsylvania to the grand total was 60.5 per cent, that of Ohio 17.1 per cent, and that of Illinois 13.5 per cent. These 3 states made 91.1 per cent of all the ingots made in 1900.

Of the total value reported 66.6 per cent was Bessemer, 29.7 per cent was open hearth, and 3.7 per cent was crucible. The steel ingots made in Pennsylvania amounted in value to 63.3 per cent of the total, in Ohio to 17.6 per cent, and in Illinois to 9.3 per cent. Combined these 3 states produced 90.2 per cent of the total value reported.

Table 62 shows the total production of castings made by the Bessemer, open-hearth, crucible, and miscellaneous processes, by states, in 1900. In order to avoid disclosing the operations of individual plants it is necessary to combine steel castings made by miscellaneous processes with those produced by the crucible process.

TABLE 62.—STEEL WORKS: PRODUCTION AND VALUE OF ALL KINDS OF STEEL CASTINGS, BY STATES, 1900.

| STATES. | TOTAL. | | BESSEMER. | | OPEN-HEARTH. | | CRUCIBLE AND MISCELLANEOUS. | |
|---|---|---|---|---|---|---|---|---|
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| United States | 177,156 | $14,609,893 | 3,761 | $322,465 | 165,529 | $13,004,591 | 7,866 | $1,282,837 |
| Connecticut and Massachusetts | 7,770 | 602,556 | ..... | ..... | 7,510 | 585,063 | 260 | 17,493 |
| Colorado and Missouri | 9,773 | 729,817 | 173 | 9,817 | 9,600 | 720,000 | ..... | ..... |
| Illinois and Indiana | 45,213 | 3,179,187 | 510 | 24,868 | 44,407 | 3,115,563 | 296 | 38,756 |
| Michigan, Minnesota, and Wisconsin | 4,647 | 497,048 | 3,000 | 278,500 | 857 | 99,380 | 790 | 119,168 |
| New Jersey and New York | 21,517 | 2,365,701 | ..... | ..... | 16,783 | 1,516,880 | 4,734 | 848,821 |
| Ohio and Tennessee | 18,525 | 1,437,282 | ..... | ..... | 18,196 | 1,416,393 | 329 | 20,889 |
| Pennsylvania | 69,711 | 5,798,302 | 78 | 9,280 | 68,176 | 5,551,312 | 1,457 | 237,710 |

[1] Gross ton of 2,240 pounds.

Table 62 shows that of the total production of steel castings in 1900, 93.4 per cent was made by the open-hearth process, 4.5 per cent by the crucible and minor processes, and 2.1 per cent by the Bessemer process. Of the grand total Pennsylvania made 39.4 per cent, Illinois 22 per cent, and Ohio 10.4 per cent, the combined production of the 3 states amounting to 71.8 per cent.

Of the total value reported, 89 per cent was made by the open-hearth process, 8.8 per cent by the crucible and minor processes, and 2.2 per cent by the Bessemer process.

The average value per ton of all kinds of castings in 1900 was $82.47. Castings were not separated from ingots in 1890 or 1880, and no comparisons can therefore be made with these two years.

Table 63 shows the total daily capacity, on double turn, in ingots and castings, of all active and idle steel plants in the United States in the census year 1900, and the production and value of the steel ingots and castings for the year named by states.

TABLE 63.—STEEL WORKS: CAPACITY OF PLANTS, PRODUCTION AND VALUE OF ALL KINDS OF STEEL INGOTS AND CASTINGS, BY STATES, 1900.

| STATES. | DAILY CAPACITY. | | | INGOTS AND CASTINGS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total. | | Ingots. | | Castings. | |
| | Total (tons).[1] | Active (tons).[1] | Idle (tons).[1] | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| United States | 58,031.5 | 53,745.0 | 4,286.5 | 10,685,000 | $212,538,875 | 10,507,844 | $197,928,982 | 177,156 | $14,609,893 |
| Alabama | 1,150.0 | 1,120.0 | 30.0 | 48,191 | 939,501 | 48,191 | 939,501 | ..... | ..... |
| California,[2] Colorado, and Missouri | 649.0 | 649.0 | ..... | 138,906 | 2,839,057 | 129,133 | 2,109,240 | 9,773 | 729,817 |
| Connecticut[3] | 28.5 | 28.5 | ..... | 2,197 | 221,862 | 1,135 | 89,420 | 1,062 | 132,442 |
| Illinois | 6,631.0 | 6,551.0 | 80.0 | 1,460,710 | 21,140,860 | 1,421,687 | 18,480,093 | 39,023 | 2,660,767 |
| Indiana | 1,167.5 | 337.5 | 830.0 | 51,967 | 1,442,485 | 45,777 | 924,065 | 6,190 | 518,420 |
| Kentucky and Maryland | 2,748.5 | 2,534.5 | 214.0 | 329,807 | 5,526,711 | 329,807 | 5,526,711 | ..... | ..... |
| Massachusetts | 676.0 | 576.0 | 100.0 | 51,552 | 2,239,554 | 44,844 | 1,769,440 | 6,708 | 470,114 |
| Michigan and Minnesota | 190.0 | 150.0 | 40.0 | 14,967 | 582,679 | 12,617 | 382,179 | 2,350 | 200,500 |
| New Jersey | 424.0 | 399.0 | 25.0 | 62,832 | 2,843,719 | 52,600 | 1,591,000 | 10,232 | 1,252,719 |
| New York | 1,060.5 | 235.5 | 825.0 | 23,232 | 1,882,482 | 11,947 | 769,500 | 11,285 | 1,112,982 |
| Ohio | 8,845.5 | 8,791.5 | 54.0 | 1,812,329 | 36,276,162 | 1,794,427 | 34,847,424 | 18,402 | 1,428,738 |
| Pennsylvania | 32,717.0 | 31,131.0 | 1,586.0 | 6,431,297 | 131,052,363 | 6,361,586 | 125,254,061 | 69,711 | 5,798,302 |
| Tennessee, Virginia, and West Virginia | 1,368.5 | 1,168.5 | 200.0 | 254,216 | 5,254,892 | 254,093 | 5,246,348 | 123 | 8,544 |
| Wisconsin | 375.5 | 73.0 | 302.5 | 2,297 | 296,548 | ..... | ..... | 2,297 | 296,548 |

[1] Gross ton of 2,240 pounds.
[2] The quantity and value of the steel produced by 1 establishment in California is included in the special report on "shipbuilding, iron and steel vessels."
[3] The quantity and value of steel produced by 1 establishment in Connecticut is included in the data for "ordnance and ordnance stores."

Table 63 shows that the total daily capacity in 1900 on double turn of the active and idle steel plants amounted to 58,031.5 tons, or, allowing 300 working days to the year, 17,409,450 tons annually. The operation of all steel plants on double turn for this period would not, however, be possible. As shown by the table, 7.4 per cent of the total capacity was idle during the entire year. This would give an approximate active annual capacity of 16,123,500 tons. Using these figures as a basis, and comparing them with the total production reported, it is found that the output in 1900 was 66.3 per cent of the total active capacity.

The average value per ton of all kinds of ingots and castings in 1900 was $19.89. Of the total production 98.3 per cent was ingots and 1.7 per cent was castings.

Pennsylvania made 60.2 per cent of the total production; Ohio, 17 per cent, and Illinois, 13.7 per cent. No other state made over 2.5 per cent.

Table 64 shows the total production of all kinds of steel ingots and castings by states for 1900, 1890, and 1880

TABLE 64.—STEEL WORKS: QUANTITY OF CRUDE STEEL INGOTS AND DIRECT STEEL CASTINGS PRODUCED, BY STATES, 1880 TO 1900.

| STATES. | TOTAL (TONS).[1] | | | BESSEMER STEEL (TONS).[1] | | | OPEN-HEARTH STEEL (TONS).[1] | | | CRUCIBLE STEEL (TONS).[1] | | | MISCELLANEOUS STEEL (TONS).[1] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1900 | 1890 | 1880 | 1900 | 1890 | 1880 | 1900 | 1890 | 1880 | 1900 | 1890 | 1880 | 1900 | 1890 | 1880 |
| United States | 10,685,000 | 4,174,652 | 1,027,381 | 7,532,028 | 3,617,198 | 879,650 | 3,044,356 | 480,035 | 75,269 | 104,393 | 73,882 | 68,037 | 4,223 | 3,537 | 4,425 |
| Alabama | 48,191 | 268 | ..... | ..... | ..... | ..... | 48,191 | 268 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| California | (2) | 7,550 | ..... | (2) | ..... | ..... | ..... | 7,550 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Colorado | 129,306 | 16,029 | ..... | 129,306 | 16,029 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Connecticut[3] | 2,197 | 1,556 | 1,964 | ..... | ..... | ..... | 802 | ..... | ..... | 1,395 | 1,556 | 1,889 | ..... | ..... | 75 |
| Illinois | 1,460,710 | 779,956 | 227,293 | 1,211,115 | 777,478 | 226,352 | 249,313 | 2,081 | 825 | 282 | 397 | 116 | ..... | ..... | ..... |
| Indiana | 51,967 | 1,116 | ..... | ..... | ..... | ..... | 51,953 | 893 | ..... | 14 | 223 | ..... | ..... | ..... | ..... |
| Kentucky | 74,737 | ..... | 312 | 74,737 | ..... | ..... | ..... | ..... | 245 | ..... | ..... | 67 | ..... | ..... | ..... |
| Maryland | 255,070 | 893 | ..... | 251,320 | ..... | ..... | 2,250 | ..... | ..... | 1,500 | 893 | ..... | ..... | ..... | ..... |
| Massachusetts | 51,552 | 26,272 | 8,585 | ..... | 14,065 | ..... | 51,552 | 11,732 | 8,460 | ..... | 475 | 125 | ..... | ..... | ..... |
| Michigan | 4,575 | 4,855 | ..... | 2,300 | 3,214 | ..... | 2,275 | ..... | ..... | ..... | 1,641 | ..... | ..... | ..... | ..... |
| Minnesota | 10,392 | ..... | ..... | 50 | ..... | ..... | 10,342 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Missouri | 9,600 | ..... | 7,508 | ..... | ..... | 7,508 | 9,600 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| New Hampshire | ..... | 3,804 | 4,037 | ..... | ..... | ..... | ..... | 3,804 | 4,037 | ..... | ..... | ..... | ..... | ..... | ..... |
| New Jersey | 62,832 | 21,149 | 10,663 | ..... | ..... | ..... | 49,912 | 13,887 | 402 | 9,600 | 6,637 | 2,368 | 3,320 | 625 | 893 |
| New York | 23,232 | 101,769 | 77,451 | ..... | 94,109 | 75,143 | 14,371 | 1,161 | ..... | 8,861 | 6,499 | 2,308 | ..... | ..... | ..... |
| Ohio | 1,812,329 | 395,574 | 96,324 | 1,697,353 | 840,266 | 78,938 | 114,926 | 55,308 | 22,064 | 550 | ..... | 322 | ..... | ..... | ..... |
| Pennsylvania | 6,431,297 | 2,652,920 | 586,994 | 3,911,127 | 2,210,730 | 496,709 | 2,487,918 | 383,851 | 82,986 | 81,349 | 55,427 | 53,842 | 908 | 2,912 | 3,457 |
| Tennessee | 146 | 134 | 3,571 | ..... | ..... | ..... | 94 | ..... | 3,571 | 52 | 134 | ..... | ..... | ..... | ..... |
| Vermont | ..... | ..... | 2,679 | ..... | ..... | ..... | ..... | ..... | 2,679 | ..... | ..... | ..... | ..... | ..... | ..... |
| West Virginia | 254,070 | 161,307 | ..... | 254,070 | 161,307 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Wisconsin | 2,297 | ..... | ..... | 650 | ..... | ..... | 857 | ..... | ..... | 790 | ..... | ..... | ..... | ..... | ..... |

[1] Gross ton of 2,240 pounds.
[2] California produced a small quantity of Tropenas steel castings in 1900, which is included in the special report on the "iron and steel shipbuilding" industry.
[3] Connecticut also produced a small quantity of Tropenas steel castings in 1900, but this production is not included in the figures given for this state.

The growth of the steel industry is most strikingly shown in this table. The increase in the manufacture of all kinds of steel in 1900 over 1890 amounted to 6,510,348 tons, or 155.9 per cent, and over 1880 to 9,657,619 tons, or 940 per cent.

Taking up the production of steel by processes, it is found that the output of Bessemer steel in 1900 increased 3,914,830 tons, or 108.2 per cent, over 1890, and 6,652,378 tons, or 756.3 per cent, over 1880. In open-hearth steel the growth was quite marked, caused chiefly

by the adoption of the basic process. In 1900 the increase over 1890 amounted to 2,564,321 tons, or 534.2 per cent, and over 1880 to 2,969,087 tons. The production of crucible steel in 1900 shows an increase over 1890 of 30,511 tons, or 41.3 per cent, and over 1880 of 36,356 tons, or 53.4 per cent. The output of crucible steel in 1900 was the largest in the history of the country.

Of the total production of steel ingots and castings in 1900, 70.5 per cent was made by the Bessemer process, 28.5 per cent by the open-hearth process, and 1 per cent by crucible and miscellaneous processes. In 1890 the Bessemer production was 86.6 per cent of the total, the open-hearth production 11.5 per cent, and the crucible and miscellaneous production 1.9 per cent. In 1880 the production of Bessemer steel amounted to 85.6 per cent of the total, open-hearth steel to 7.3 per cent, and crucible and miscellaneous steel to 7.1 per cent.

Pennsylvania made 60.2 per cent of the total production of steel in 1900, 63.5 per cent in 1890, and 57.1 per cent in 1880; Ohio made 17 per cent in 1900, 9.5 per cent in 1890, and 9.4 per cent in 1880; and Illinois made 13.7 per cent in 1900, 18.7 per cent in 1890, and 22.1 per cent in 1880. The combined production of these 3 leading steel-producing states was 90.9 per cent of the total in 1900, 91.7 per cent in 1890, and 88.6 per cent in 1880.

The following states which produced steel in 1900 were not producers in 1880: Alabama, California, Colorado, Indiana, Maryland, Michigan, Minnesota, West Virgina, and Wisconsin. On the other hand, Vermont, which made steel in 1880, was not a producer in 1890 or 1900. Kentucky and Missouri, which made steel in 1880 but not in 1890, appear again as producers in 1900. Minnesota and Wisconsin report steel in 1900 for the first time in any of the three periods named in the table. New Hampshire, which made steel in 1890, has given up its manufacture entirely, and does not appear as a producer in 1900.

### MACHINERY.

Table 65 shows the equipment and capacity of the rolling mills and steel works in 1900 as compared with 1890 and 1880.

TABLE 65.—ROLLING MILLS AND STEEL WORKS: EQUIPMENT AND CAPACITY, ACTIVE AND IDLE ESTABLISHMENTS, 1880 TO 1900.

| | 1900 | 1890 | 1880 |
|---|---|---|---|
| Rolling mills and steel works: | | | |
| Number of establishments | 476 | 429 | 391 |
| Total daily capacity, finished rolled and forged products, tons, double turn | [1] 90,122 | [1] 41,576 | [1] 19,730 |
| Bessemer steel establishments, included above | 42 | 51 | 11 |
| Bessemer converters, number | 91 | 97 | 24 |
| Total daily capacity, tons of ingots, double turn | [1] 38,420 | [1] 19,285 | [1] 8,988 |
| Open-hearth steel establishments, included above | 96 | 58 | 25 |
| Open-hearth furnaces, number | 331 | 129 | 37 |
| Total daily capacity, tons of ingots, double turn | [1] 19,030 | [1] 8,608 | [1] 788 |
| Acid, furnaces | 152 | [2] | [2] |
| Daily capacity, tons of acid ingots, double turn | [1] 6,419 | [2] | [2] |
| Basic, furnaces | 179 | [2] | [2] |
| Daily capacity, tons of basic ingots, double turn | [1] 12,611 | [2] | [2] |
| Crucible steel establishments, included above | 40 | 47 | 37 |
| Crucible pots, which can be used at a heat | 2,619 | 2,606 | 2,691 |

[1] Gross ton of 2,240 pounds. [2] Not reported.

## PART IV.—THE MANUFACTURE OF IRON BLOOMS AND HAMMERED BAR IRON FOR SALE.

### FORGES AND BLOOMERIES.

The statistics given below relate only to the manufacture for sale of hammered charcoal blooms, billets, and bar iron direct from iron ore and of hammered charcoal blooms, billets, and bars from pig iron and from scrap iron and steel. The production of establishments which consume in their own works the charcoal blooms or bars made is not included in any of the tables.

The products of a "forge" are hammered blooms and bars made direct from iron ore; the products of a "bloomery" are hammered blooms, bars, etc., made from pig iron and scrap iron and steel.

In 1880 there were 93 active establishments engaged in the manufacture for sale of hammered blooms, bars, etc., located in 8 states, namely, Missouri, New Jersey, New York, Pennsylvania, Georgia, North Carolina, Tennessee, and Virginia. In the 4 states first named blooms and billets were produced, while in the 4 states last named hammered bar iron was made. In 1890 the number of active establishments had declined to 20, the producing states being New York, Pennsylvania, Maryland, and New Jersey. In the state first named charcoal blooms and billets only were made, all being produced direct from the ore. In the other states hammered blooms and billets from pig and scrap iron were produced.

In 1900, 7 establishments only were engaged in the manufacture for sale of hammered charcoal blooms, billets, and bars, located in New York, Pennsylvania, and Maryland. As in 1890, the New York establishment made its entire product direct from the ore, while Pennsylvania used pig iron and scrap iron and steel and Maryland scrap iron and steel only in producing the blooms, billets, and bars made.

Blooms and billets made direct from iron ore are largely used in the manufacture of crucible steel, especially when fine grades of tool steel are desired, while billets, blooms, etc., made from pig iron and from scrap iron and steel are as a rule rolled into plates, sheets, skelp rods, etc., and used in the manufacture of boiler tubes, boilers, screws, rivets, wire, etc.

Table 66 shows the leading statistics for the forge and bloomery industry for the census years 1900, 1890, 1880, and 1870.

TABLE 66.—FORGES AND BLOOMERIES: 1870 TO 1900.[1]

| | DATE OF CENSUS. | | | |
|---|---|---|---|---|
| | 1900. | 1890. | 1880. | 1870.[2] |
| Number of establishments | 7 | 20 | 93 | 82 |
| Capital | [3]$508,388 | $876,470 | $3,915,213 | $4,506,733 |
| Salaried officials, clerks, etc., number | 12 | [4]15 | (5) | (5) |
| Salaries | $11,500 | [4]$17,309 | (5) | (5) |
| Wage-earners, average number | 226 | 471 | 2,939 | 2,902 |
| Total wages | $97,184 | $199,065 | $915,395 | $195,964 |
| Men, 16 years and over | 226 | 468 | 2,875 | 2,819 |
| Wages | $97,184 | $198,705 | (5) | (5) |
| Women, 16 years and over | ..... | ..... | 3 | 2 |
| Wages | ..... | ..... | (5) | (5) |
| Children, under 16 years | ..... | 3 | 61 | 81 |
| Wages | ..... | $360 | (5) | (5) |
| Miscellaneous expenses | $15,203 | $54,680 | (6) | (6) |
| Cost of material used | $327,160 | $905,208 | $2,546,915 | $5,685,466 |
| Value of products[7] | $522,432 | $1,183,494 | $3,968,074 | $7,647,054 |
| Tons of products[8] | 15,497 | 31,049 | 64,783 | 98,936 |

[1] This summary includes only active establishments for 1880, 1890, and 1900; such establishments were not reported separately in 1870.
[2] See remarks in regard to the depreciated currency of 1870, and inclusion of capital, employees, and wages for mining, etc., for 1880.
[3] Includes rented property valued at $236,000; no rented property reported for previous censuses.
[4] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this summary. (See Table 73.)
[5] Not reported separately.
[6] Not reported.
[7] Includes values for which tonnage was not reported.
[8] Gross ton of 2,240 pounds.

In 1900 as compared with 1890 there was a decrease of 13 in the number of active establishments, of $368,082 in the capital invested, of 245 in the number of wage-earners, of $101,881 in the amount of wages paid, of $578,048 in the cost of materials, of $661,062 in the value of products, and of 15,552 tons in the production of hammered blooms, billets, bars, etc. Compared with 1880 the decline was even more marked, the decrease in the number of establishments amounting to 86, in capital to $3,406,825, in wage-earners to 2,713, in wages to $818,211, in the cost of materials to $2,219,755, in the value of products to $3,445,642, and in output to 49,286 tons.

### CAPITAL.

Table 67 shows the capital invested in active and idle forge and bloomery establishments in 1900, 1890, and 1880. Attention is called to the fact that not a single forge or bloomery for the production of blooms, billets, bars, etc., for sale was in course of construction at any of the three periods named in the table.

TABLE 67.—FORGES AND BLOOMERIES: DISTRIBUTION OF CAPITAL, ACTIVE AND IDLE ESTABLISHMENTS, 1880 TO 1900.

| CLASSES. | Year. | Number of establishments. | CAPITAL. | | |
|---|---|---|---|---|---|
| | | | Total. | Buildings, machinery, tools, and implements. | Land, cash, and sundries. |
| Total | 1900 | 14 | [1]$619,488 | $236,420 | $383,068 |
| | 1890 | 32 | 1,074,970 | 462,500 | 612,470 |
| | 1880 | 118 | 4,395,963 | 2,301,550 | 2,094,413 |
| Active establishments | 1900 | 7 | 508,388 | 184,420 | 323,968 |
| | 1890 | 20 | 876,470 | 338,000 | 538,470 |
| | 1880 | 93 | 3,915,213 | 2,018,800 | 1,896,413 |
| Idle establishments | 1900 | 7 | 111,100 | 52,000 | 59,100 |
| | 1890 | 12 | 198,500 | 124,500 | 74,000 |
| | 1880 | 25 | 480,750 | 282,750 | 198,000 |

[1] Includes rented property valued at $236,000; no rented property reported for previous censuses.

Exactly one-half of the existing forges and bloomeries in 1900 were idle. In 1890 three-eighths were idle, the active numbering 20 and the idle 12, while in 1880 a little over one-fifth were idle, the active numbering 93 and the idle 25. The active plants in 1900 were chiefly engaged in the production of material for special work. The industry is not likely to assume any importance in the immediate future.

In 1880 the capital invested in buildings, machinery, tools, etc., was slightly in excess of the amount invested in land, stock, etc. In 1890, however, the investment in buildings and machinery was considerably smaller than the investment reported for land and stock. In 1900 the investment in the latter items exceeded the investment in the former items by almost $150,000. If the total capital reported for the active and idle establishments in 1900 is compared with the capital reported for the idle establishments alone in 1880, it is found that the former exceeded the latter by only $138,738.

Of the 7 idle establishments reported for 1900, 4 were located in Pennsylvania, 1 in Maryland, 1 in New Jersey, and 1 in North Carolina. With the single exception of the North Carolina plant all the idle establishments were equipped for the manufacture of hammered blooms, billets, etc., from pig iron and scrap iron and steel. The establishment in North Carolina produced, when in operation, finished hammered bars direct from the ore. It has been idle for several years, its last products having been turned out in 1896. It then found a ready sale for its bars in North Carolina and Virginia, the price realized being about 5 cents per pound. The forge has an annual capacity of about 75 tons of finished bars, but it seldom produced over 50 tons. Local magnetic ore was used. This forge is the last of its kind, although twenty or thirty years ago it had scores of counterparts in the mountainous districts of the South. Many of these forges were owned and operated by farmers, who ran them only when the local demand for iron would justify their operation, and when the water in the mountain streams was high enough to furnish the power to blow the fires and to drive their hammers. One by one these forges have been abandoned and dismantled. So far as the South is concerned, this branch of the industry is practically extinct.

Of the 3 states which produced hammered charcoal blooms, billets, or bars in 1900, 2, New York and Maryland each reported 1 active establishment. The remaining 5 active establishments were all located in Pennsylvania. This state made 55.9 per cent of the total production of 1900, Maryland 24.9 per cent, and New York 19.2 per cent.

### MATERIALS USED.

Table 68 shows in detail the quantity and cost of the materials used by forges and bloomeries in 1900, 1890, and 1880. With the exception of charcoal, which is reported in bushels, all quantities are given in gross

tons of 2,240 pounds. Comparisons of cost for the iron ore, pig iron, scrap iron and steel, fuel, etc., consumed in 1900 can not be made with the cost reported for these items in 1890 or 1880, as in the year first named the amount paid as freight is sometimes included and sometimes excluded in the cost reported for each material. In both 1890 and 1880, however, the cost reported for ore, scrap, fuel, etc., was the cost at works, all freight charges being invariably included. In 1900, when the freight charges are not included in the cost of the materials named, they have been added to "all other materials."

TABLE 68.—FORGES AND BLOOMERIES: QUANTITY AND COST OF MATERIALS USED, 1880 TO 1900.

| CLASSES. | 1900 | | 1890 | | 1880 | |
|---|---|---|---|---|---|---|
| | Gross tons. | Cost. | Gross tons. | Cost. | Gross tons. | Cost. |
| Total | ..... | $327,160 | ..... | $905,208 | ..... | $2,546,915 |
| Iron ore | 6,282 | 22,414 | 16,792 | 110,587 | 71,080 | 531,540 |
| Pig iron | 1,000 | 22,000 | 7,346 | 145,867 | 34,029 | 945,376 |
| Old or scrap iron and steel | 13,693 | 181,766 | 21,429 | 359,777 | 7,976 | 215,576 |
| Charcoal | [1]1,538,280 | 85,241 | [1]4,056,435 | 270,082 | [1]13,014,361 | 812,616 |
| Anthracite coal and culm | ..... | ..... | 355 | 946 | 304 | 1,220 |
| Bituminous coal and slack | 1,553 | 2,771 | 1,161 | 3,300 | 1,440 | 4,298 |
| Coke | 60 | 240 | 1,254 | 5,604 | 5,978 | 31,241 |
| All other materials | ..... | 12,728 | ..... | 9,045 | ..... | 5,050 |

[1] Bushels.

This table shows the change that has taken place from 1880 to 1900 in the character of the material used as well as the decadence of the industry itself. Twenty years ago the pig iron used amounted to 34,029 tons and the scrap iron and steel to 7,976 tons. In 1890 the pig iron consumed fell to 7,346 tons and the scrap iron and steel increased to 21,429 tons. In 1900 the pig iron used amounted to only 1,000 tons, while the scrap iron and steel amounted to 13,693 tons. It is thus shown that the use of pig iron in the manufacture of hammered charcoal blooms, billets, bars, etc., has been greatly reduced, nearly all the product reported for 1900 having been made from scrap iron or steel, of course excepting the quantity made from iron ore direct. The pig iron consumed in 1900 was reported by 1 establishment in the state of Pennsylvania and was all made with charcoal as fuel.

Table 69 shows the quantity and value of the products of forges and bloomeries.

TABLE 69.—FORGES AND BLOOMERIES: QUANTITY AND VALUE OF PRODUCTS, 1880 TO 1900.

| CLASSES. | 1900 | | 1890 | | 1880 | |
|---|---|---|---|---|---|---|
| | Tons.[1] | Value. | Tons.[1] | Value. | Tons.[1] | Value. |
| Total | ..... | $522,432 | ..... | $1,183,494 | ..... | $3,968,074 |
| Blooms and bar iron direct from iron ore | 3,142 | 114,413 | 8,346 | 356,843 | 33,601 | 1,812,380 |
| Blooms, billets, etc., from pig iron and scrap iron and steel | 12,355 | 403,194 | 22,704 | 821,168 | 31,182 | 2,129,933 |
| All other products | ..... | 4,825 | ..... | 5,483 | ..... | 25,761 |

[1] Gross ton of 2,240 pounds.

The production of blooms and bars from ore declined from 33,601 tons in 1880 to 8,346 tons in 1890 and to 3,142 tons in 1900, and the production of blooms, billets, etc., from pig iron and scrap iron and steel from 31,182 tons in 1880 to 22,704 tons in 1890, and to 12,355 tons in 1900. The decline in the production of both products was from 64,783 tons in 1880 to 31,050 tons in 1890, and to 15,497 tons in 1900.

The average value of the blooms and bars made direct from the ore in 1900 was $35.41 per ton, as compared with $42.76 per ton in 1890 and $53.94 per ton in 1880. The blooms, billets, etc., made from pig iron and from scrap iron and steel, averaged $32.63 per ton in 1900, compared with $36.17 per ton in 1890 and $68.31 per ton in 1880. In addition to the hammered blooms, billets, and bars reported in 1900, miscellaneous products to the value of $4,825 were produced.

### MACHINERY.

Table 70 shows the number of active and idle forges and bloomeries and their daily capacity for 1880, 1890, and 1900.

TABLE 70.—FORGES AND BLOOMERIES: EQUIPMENT AND TOTAL DAILY CAPACITY, ACTIVE AND IDLE, 1880 TO 1900.

| | 1900 | 1890 | 1880 |
|---|---|---|---|
| Number of forges and bloomeries | 14 | 32 | 118 |
| Number of forge fires | 111 | 202 | 495 |
| Number of hammers | 18 | 39 | 141 |
| Total daily capacity, in tons, of blooms, billets, and bars, double turn[1] | 143 | 263 | 464 |

[1] Gross ton of 2,240 pounds.

### POWER.

The 7 active forge and bloomery establishments reported 547 horsepower, divided as follows: Steam engines, 13, with an aggregate of 447 horsepower; and water wheels, 2, with an aggregate of 100 horsepower.

### GENERAL TABLES.

The following summaries present in detail the statistics for the iron and steel industry, as reported at the census for 1900, by totals for the United States and for each state having 3 or more establishments. States having less than 3 establishments are grouped in order to avoid disclosing the operations of individual establishments. Table 71 presents the statistics relating to blast furnaces; Table 72, those relating to rolling mills and steel works; and Table 73, the statistics of forges and bloomeries.

TABLE 71, PART I.—BLAST FURNACES:

[The ton when used as a unit of measure

| | | United States. | Alabama. | Georgia. | Illinois. | Maryland. |
|---|---|---|---|---|---|---|
| 1 | Number of establishments[1] | 223 | 19 | 3 | 4 | 3 |
| | Character of organization: | | | | | |
| 2 | Individual | 9 | ..... | ..... | ..... | 1 |
| 3 | Firm and limited partnership | 18 | ..... | ..... | ..... | ..... |
| 4 | Incorporated company | 196 | 19 | 3 | 4 | 2 |
| | Capital: | | | | | |
| 5 | Total | $143,159,232 | $11,587,184 | $655,916 | $10,683,913 | $1,388,000 |
| 6 | Land | $12,832,412 | $777,188 | $175,000 | $2,084,240 | $13,000 |
| 7 | Buildings | $48,218,612 | $6,895,189 | $295,000 | $2,328,386 | $938,000 |
| 8 | Machinery, tools, and implements | $26,939,638 | $664,652 | $113,880 | $2,935,276 | $285,000 |
| 9 | Cash and sundries | $55,168,570 | $3,250,205 | $72,036 | $3,336,011 | $152,000 |
| | Rented property: | | | | | |
| 10 | Total | $4,896,881 | $103,000 | $11,000 | ..... | ..... |
| 11 | Land | $897,942 | $11,000 | $1,000 | ..... | ..... |
| 12 | Buildings | $3,266,452 | $82,000 | $10,000 | ..... | ..... |
| 13 | Machinery, tools, and implements | $732,487 | $10,000 | ..... | ..... | ..... |
| 14 | Proprietors and firm members | 48 | ..... | ..... | ..... | ..... |
| | Salaried officials, clerks, etc.: | | | | | |
| 15 | Total number | 1,757 | 148 | 18 | 210 | 14 |
| 16 | Total salaries | $2,304,120 | $237,313 | $13,295 | $294,524 | $17,148 |
| | Officers of corporations— | | | | | |
| 17 | Number | 288 | 36 | 3 | 9 | ..... |
| 18 | Salaries | $834,085 | $126,621 | $4,505 | $28,473 | ..... |
| | General superintendents, managers, clerks, etc.— | | | | | |
| 19 | Total number | 1,469 | 112 | 15 | 201 | 14 |
| 20 | Total salaries | $1,470,035 | $110,692 | $8,790 | $266,051 | $17,148 |
| | Men— | | | | | |
| 21 | Number | 1,408 | 112 | 14 | 182 | 13 |
| 22 | Salaries | $1,444,098 | $110,692 | $8,695 | $253,675 | $17,068 |
| | Women— | | | | | |
| 23 | Number | 61 | ..... | 1 | 19 | 1 |
| 24 | Salaries | $25,937 | ..... | $95 | $12,376 | $80 |
| | Wage-earners, including pieceworkers, and total wages: | | | | | |
| 25 | Greatest number employed at any one time during the year | 49,989 | 6,536 | 377 | 3,630 | 965 |
| 26 | Least number employed at any one time during the year | 34,708 | 4,636 | 138 | 2,170 | 376 |
| 27 | Average number | 39,241 | 5,034 | 194 | 3,010 | 659 |
| 28 | Wages | $18,484,400 | $1,382,017 | $48,391 | $2,176,274 | $802,068 |
| | Men, 16 years and over— | | | | | |
| 29 | Average number | 39,144 | 5,021 | 188 | 3,009 | 657 |
| 30 | Wages | $18,464,587 | $1,379,839 | $47,959 | $2,175,882 | $801,600 |
| | Women, 16 years and over— | | | | | |
| 31 | Average number | 6 | ..... | ..... | 1 | ..... |
| 32 | Wages | $1,352 | ..... | ..... | $392 | ..... |
| | Children, under 16 years— | | | | | |
| 33 | Average number | 91 | 13 | 6 | ..... | 2 |
| 34 | Wages | $18,461 | $2,178 | $432 | ..... | $468 |
| | Average number of wage-earners, including pieceworkers, employed during each month: | | | | | |
| | Men, 16 years and over— | | | | | |
| 35 | January | 37,167 | 5,169 | 305 | 2,298 | 400 |
| 36 | February | 37,878 | 4,840 | 325 | 2,744 | 362 |
| 37 | March | 38,967 | 5,080 | 337 | 2,804 | 598 |
| 38 | April | 38,865 | 5,140 | 302 | 2,738 | 723 |
| 39 | May | 39,021 | 5,255 | 95 | 3,044 | 615 |
| 40 | June | 36,486 | 4,739 | 60 | 3,023 | 604 |
| 41 | July | 38,108 | 4,894 | 60 | 3,361 | 689 |
| 42 | August | 39,026 | 4,734 | 60 | 3,363 | 795 |
| 43 | September | 39,614 | 4,562 | 120 | 3,282 | 738 |
| 44 | October | 40,958 | 5,036 | 170 | 3,198 | 690 |
| 45 | November | 41,585 | 5,374 | 185 | 3,210 | 782 |
| 46 | December | 42,033 | 5,422 | 238 | 3,048 | 881 |
| | Women, 16 years and over— | | | | | |
| 47 | January | 6 | ..... | ..... | 1 | ..... |
| 48 | February | 6 | ..... | ..... | 1 | ..... |
| 49 | March | 6 | ..... | ..... | 1 | ..... |
| 50 | April | 6 | ..... | ..... | 1 | ..... |
| 51 | May | 6 | ..... | ..... | 1 | ..... |
| 52 | June | 4 | ..... | ..... | 1 | ..... |
| 53 | July | 5 | ..... | ..... | 1 | ..... |
| 54 | August | 5 | ..... | ..... | 1 | ..... |
| 55 | September | 5 | ..... | ..... | 1 | ..... |
| 56 | October | 6 | ..... | ..... | 1 | ..... |
| 57 | November | 6 | ..... | ..... | 1 | ..... |
| 58 | December | 6 | ..... | ..... | 1 | ..... |
| | Children, under 16 years— | | | | | |
| 59 | January | 79 | 12 | 10 | ..... | 2 |
| 60 | February | 88 | 13 | 9 | ..... | 2 |
| 61 | March | 87 | 13 | 12 | ..... | 2 |
| 62 | April | 84 | 12 | 11 | ..... | 2 |
| 63 | May | 80 | 13 | ..... | ..... | 2 |
| 64 | June | 89 | 13 | ..... | ..... | 2 |
| 65 | July | 95 | 12 | ..... | ..... | 2 |
| 66 | August | 100 | 13 | ..... | ..... | 2 |
| 67 | September | 99 | 12 | 6 | ..... | 2 |
| 68 | October | 103 | 14 | 7 | ..... | 2 |
| 69 | November | 97 | 13 | 7 | ..... | 2 |
| 70 | December | 94 | 13 | 8 | ..... | 2 |
| | Miscellaneous expenses: | | | | | |
| 71 | Total | $7,463,234 | $788,389 | $8,300 | $691,724 | $147,634 |
| 72 | Rent of works | $487,031 | $1,075 | ..... | ..... | ..... |
| 73 | Taxes, not including internal revenue | $523,693 | $58,232 | $1,766 | $57,828 | $4,444 |
| 74 | Rent of offices, interest, insurance, and all sundry expenses not hitherto included. | $6,349,219 | $729,082 | $6,384 | $633,896 | $143,190 |
| 75 | Contract work | $103,291 | ..... | $150 | ..... | ..... |
| | Materials used: | | | | | |
| 76 | Total cost | $131,503,655 | $7,610,270 | $237,421 | $11,707,965 | $2,562,412 |
| | Iron ore— | | | | | |
| | Domestic— | | | | | |
| 77 | Tons | 24,612,511 | 2,795,460 | 44,981 | 2,431,809 | 106,578 |
| 78 | Cost | $61,795,473 | $2,287,595 | $67,777 | $6,022,802 | $326,674 |
| | Foreign— | | | | | |
| 79 | Tons | 754,383 | ..... | ..... | 7,965 | 311,608 |
| 80 | Cost | $4,107,449 | ..... | ..... | $118,387 | $1,121,527 |

[1] The figures for the various items in this table do not agree with the corresponding figures for 1900 in all other tables, because the figures for a blast furnace in Texas, operated by a penal institution, have been excluded. This institution reported $170,000 invested as capital, 6 salaried employees who were paid $4,300, and 117 wage-earners who received $16,062. Materials costing $32,769 were used, and 4,443 tons of charcoal pig iron, valued at $66,645, were produced. The furnace had a daily capacity of 25 gross tons.

DETAILED SUMMARY, BY STATES, 1900.[1]

is the gross ton of 2,240 pounds.]

| Michigan. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[2] | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 9 | 9 | 43 | 77 | 13 | 16 | 3 | 5 | 12 | 1 |
| ..... | 1 | ..... | 1 | 2 | 2 | 1 | ..... | ..... | 1 | 2 |
| ..... | 1 | ..... | 3 | 11 | ..... | 1 | ..... | ..... | 2 | 3 |
| 7 | 7 | 9 | 39 | 64 | 11 | 14 | 3 | 5 | 9 | 4 |
| $2,029,713 | $2,254,639 | $8,396,161 | $22,347,130 | $72,512,725 | $5,251,595 | $4,782,752 | $1,080,553 | $1,636,565 | $3,552,386 | 5 |
| $181,687 | $131,700 | $261,531 | $1,403,624 | $6,191,417 | $690,460 | $410,096 | $140,390 | $141,917 | $230,162 | 6 |
| $422,853 | $900,008 | $1,098,941 | $6,445,753 | $21,049,869 | $2,764,364 | $2,377,768 | $389,820 | $445,549 | $1,867,162 | 7 |
| $88,440 | $228,380 | $282,828 | $4,851,290 | $15,881,279 | $341,063 | $651,833 | $239,529 | $152,758 | $223,430 | 8 |
| $1,336,733 | $994,551 | $1,752,861 | $9,646,463 | $29,390,160 | $1,455,708 | $1,343,055 | $310,814 | $896,341 | $1,231,682 | 9 |
| ..... | $220,000 | $607,480 | $949,000 | $2,337,701 | $51,500 | $245,000 | ..... | $255,200 | $117,000 | 10 |
| ..... | $80,000 | $135,207 | $396,300 | $221,800 | $20,000 | $5,000 | ..... | $65,000 | $12,035 | 11 |
| ..... | $175,000 | $367,593 | $392,000 | $1,801,159 | $30,000 | $190,000 | ..... | $165,000 | $53,700 | 12 |
| ..... | $15,000 | $104,080 | $160,700 | $314,742 | $1,500 | $50,000 | ..... | $25,200 | $50,665 | 13 |
| ..... | 1 | ..... | 17 | 28 | 1 | ..... | ..... | ..... | 1 | 14 |
| 44 | 50 | 45 | 286 | 609 | 81 | 116 | 24 | 26 | 86 | 15 |
| $64,461 | $44,888 | $81,221 | $342,271 | $786,852 | $103,258 | $146,764 | $21,051 | $41,825 | $109,259 | 16 |
| 12 | 13 | 12 | 47 | 92 | 23 | 25 | 2 | 6 | 8 | 17 |
| $20,800 | $21,851 | $41,874 | $148,507 | $279,660 | $50,231 | $57,739 | $8,350 | $18,857 | $26,617 | 18 |
| 32 | 37 | 33 | 239 | 517 | 58 | 91 | 22 | 20 | 78 | 19 |
| $43,651 | $23,037 | $39,347 | $193,764 | $507,192 | $53,027 | $89,025 | $12,701 | $22,968 | $82,642 | 20 |
| 30 | 35 | 30 | 229 | 502 | 56 | 91 | 21 | 19 | 74 | 21 |
| $42,771 | $22,462 | $38,443 | $189,490 | $504,426 | $51,907 | $89,025 | $12,557 | $22,198 | $80,689 | 22 |
| 2 | 2 | 3 | 10 | 15 | 2 | ..... | 1 | 1 | 4 | 23 |
| $880 | $575 | $904 | $4,274 | $2,766 | $1,120 | ..... | $144 | $770 | $1,953 | 24 |
| 616 | 991 | 1,391 | 7,624 | 19,950 | 2,149 | 2,320 | 601 | 608 | 2,231 | 25 |
| 416 | 732 | 1,087 | 5,546 | 13,965 | 1,636 | 1,591 | 417 | 483 | 1,615 | 26 |
| 513 | 589 | 1,033 | 6,039 | 16,075 | 1,763 | 1,594 | 492 | 551 | 1,695 | 27 |
| $216,030 | $292,213 | $632,393 | $3,286,644 | $8,038,016 | $488,929 | $528,567 | $227,235 | $307,733 | $607,890 | 28 |
| 513 | 589 | 1,032 | 6,032 | 16,018 | 1,760 | 1,591 | 492 | 551 | 1,691 | 29 |
| $216,030 | $292,213 | $632,151 | $3,285,074 | $8,024,628 | $488,429 | $528,237 | $227,235 | $307,733 | $607,577 | 30 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 31 |
| ..... | ..... | $242 | $210 | $508 | ..... | ..... | ..... | ..... | ..... | 32 |
| ..... | ..... | ..... | 6 | 54 | 3 | 3 | ..... | ..... | 4 | 33 |
| ..... | ..... | ..... | $1,360 | $12,880 | $500 | $330 | ..... | ..... | $313 | 34 |
| 453 | 573 | 1,089 | 5,700 | 15,069 | 1,690 | 1,623 | 597 | 547 | 1,654 | 35 |
| 438 | 605 | 1,081 | 5,966 | 15,519 | 1,682 | 1,636 | 549 | 506 | 1,675 | 36 |
| 430 | 621 | 1,072 | 6,227 | 15,671 | 1,648 | 1,764 | 503 | 526 | 1,686 | 37 |
| 498 | 547 | 1,129 | 5,727 | 15,887 | 1,710 | 1,752 | 468 | 483 | 1,761 | 38 |
| 545 | 544 | 1,103 | 5,620 | 15,627 | 1,777 | 1,824 | 497 | 549 | 1,926 | 39 |
| 557 | 572 | 581 | 5,466 | 15,281 | 1,692 | 1,332 | 464 | 570 | 1,545 | 40 |
| 574 | 630 | 754 | 5,961 | 15,628 | 1,864 | 1,249 | 468 | 563 | 1,413 | 41 |
| 565 | 491 | 995 | 6,193 | 16,020 | 1,927 | 1,291 | 489 | 569 | 1,534 | 42 |
| 554 | 553 | 1,092 | 6,496 | 16,432 | 1,692 | 1,386 | 491 | 557 | 1,659 | 43 |
| 593 | 686 | 1,109 | 6,310 | 16,821 | 1,810 | 1,624 | 494 | 581 | 1,827 | 44 |
| 503 | 614 | 1,278 | 6,357 | 17,062 | 1,838 | 1,616 | 484 | 579 | 1,753 | 45 |
| 451 | 629 | 1,101 | 6,364 | 17,194 | 1,884 | 1,997 | 451 | 583 | 1,840 | 46 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 47 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 48 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 49 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 50 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 51 |
| ..... | ..... | 1 | ..... | 2 | ..... | ..... | ..... | ..... | ..... | 52 |
| ..... | ..... | 1 | 1 | 2 | ..... | ..... | ..... | ..... | ..... | 53 |
| ..... | ..... | 1 | 1 | 2 | ..... | ..... | ..... | ..... | ..... | 54 |
| ..... | ..... | 1 | 1 | 2 | ..... | ..... | ..... | ..... | ..... | 55 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 56 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 57 |
| ..... | ..... | 1 | 1 | 3 | ..... | ..... | ..... | ..... | ..... | 58 |
| ..... | ..... | ..... | 7 | 42 | 2 | 1 | ..... | ..... | 3 | 59 |
| ..... | ..... | ..... | 7 | 45 | 3 | 1 | ..... | ..... | 3 | 60 |
| ..... | ..... | ..... | 7 | 44 | 4 | 1 | ..... | ..... | 4 | 61 |
| ..... | ..... | ..... | 7 | 46 | 2 | 1 | ..... | ..... | 3 | 62 |
| ..... | ..... | ..... | 7 | 51 | 2 | 2 | ..... | ..... | 3 | 63 |
| ..... | ..... | ..... | 4 | 58 | 2 | 7 | ..... | ..... | 3 | 64 |
| ..... | ..... | ..... | 5 | 58 | 4 | 7 | ..... | ..... | 7 | 65 |
| ..... | ..... | ..... | 4 | 63 | 4 | 7 | ..... | ..... | 7 | 66 |
| ..... | ..... | ..... | 7 | 60 | 4 | 1 | ..... | ..... | 7 | 67 |
| ..... | ..... | ..... | 7 | 65 | 4 | 1 | ..... | ..... | 3 | 68 |
| ..... | ..... | ..... | 7 | 60 | 3 | 1 | ..... | ..... | 4 | 69 |
| ..... | ..... | ..... | 7 | 58 | 2 | 1 | ..... | ..... | 3 | 70 |
| $131,047 | $90,619 | $288,587 | $1,266,259 | $3,269,022 | $214,207 | $160,399 | $58,787 | $109,478 | $238,782 | 71 |
| $250 | $500 | $40,100 | $88,664 | $301,217 | $10,147 | $18,750 | ..... | $10,280 | $21,098 | 72 |
| $21,177 | $7,484 | $16,303 | $68,291 | $202,318 | $20,709 | $24,280 | $6,129 | $20,281 | $14,441 | 73 |
| $103,236 | $82,635 | $229,964 | $1,081,817 | $2,698,987 | $183,291 | $122,369 | $52,658 | $78,967 | $203,243 | 74 |
| $6,384 | ..... | $2,220 | $27,987 | $66,550 | ..... | ..... | ..... | ..... | ..... | 75 |
| $1,404,924 | $1,987,594 | $3,508,100 | $23,543,473 | $64,095,277 | $3,168,581 | $4,374,316 | $1,693,042 | $2,015,134 | $3,595,146 | 76 |
| 266,331 | 212,317 | 626,659 | 4,304,263 | 10,641,035 | 889,449 | 988,992 | 300,761 | 378,588 | 675,293 | 77 |
| $447,898 | $672,124 | $1,469,478 | $12,204,486 | $32,294,561 | $1,169,781 | $1,701,132 | $969,806 | $637,443 | $1,524,031 | 78 |
| ..... | 18,012 | 1,000 | ..... | 415,798 | ..... | ..... | ..... | ..... | ..... | 79 |
| ..... | $104,918 | $15,000 | ..... | $2,747,617 | ..... | ..... | ..... | ..... | ..... | 80 |

[2] Includes establishments distributed as follows: Colorado, 1; Connecticut, 1; Kentucky, 2; Massachusetts, 1; Minnesota, 1; Missouri, 2; North Carolina, 2; Texas, 2.
[3] Includes only active establishments.

TABLE 71, PART I.—BLAST FURNACES:

[The ton when used as a unit of measure

| | | United States. | Alabama. | Georgia. | Illinois. | Maryland. |
|---|---|---|---|---|---|---|
| | Materials used—Continued. | | | | | |
| | Total cost—Continued. | | | | | |
| | Fluxing materials— | | | | | |
| 81 | Tons | 7,324,743 | 685,278 | 9,191 | 554,906 | 111,860 |
| 82 | Cost | $5,054,725 | $338,086 | $4,177 | $502,680 | $120,004 |
| | Fuel— | | | | | |
| | Anthracite coal and culm— | | | | | |
| 83 | Tons | 886,564 | | | | 3,786 |
| 84 | Cost | $2,297,419 | | | | $15,334 |
| | Bituminous coal, used raw, and slack— | | | | | |
| 85 | Tons | 832,235 | 60,086 | | 81,192 | 6,368 |
| 86 | Cost | $1,101,312 | $73,806 | | $116,607 | $9,125 |
| | Coke— | | | | | |
| 87 | Tons | 14,697,797 | 1,806,661 | 3,839 | 1,313,144 | 283,334 |
| 88 | Cost | $38,976,770 | $4,010,913 | $21,500 | $4,554,377 | $861,921 |
| | Charcoal— | | | | | |
| 89 | Bushels | 30,677,585 | 5,281,168 | 1,981,106 | | 248,005 |
| 90 | Cost | $1,823,881 | $308,512 | $104,488 | | $11,160 |
| | Mill cinder, scrap, etc.— | | | | | |
| 91 | Tons | 1,600,313 | 6,602 | | 107,412 | 12,833 |
| 92 | Cost | $3,772,385 | $6,974 | | $255,054 | $35,060 |
| 93 | Mill supplies | $1,767,622 | $270,564 | $2,015 | $109,213 | $31,829 |
| 94 | All other materials | $1,194,628 | $100,718 | $1,600 | $28,845 | $700 |
| 95 | Freight | $9,611,991 | $213,162 | $35,914 | | $28,178 |
| | Products: | | | | | |
| 96 | Aggregate value | $206,756,557 | $13,487,769 | $391,599 | $15,153,646 | $3,072,746 |
| | Pig iron— | | | | | |
| 97 | Total tons[3] | 14,447,791 | 1,203,277 | 21,505 | 1,469,530 | 241,172 |
| 98 | Total value[3] | $206,512,755 | $13,487,769 | $386,271 | $15,033,696 | $3,060,870 |
| | Cold-blast charcoal— | | | | | |
| 99 | Tons | 12,068 | | | | |
| 100 | Value | $276,917 | | | | |
| | Hot or warm blast charcoal— | | | | | |
| 101 | Tons | 287,056 | 49,603 | 19,083 | | 2,356 |
| 102 | Value | $4,995,177 | $841,799 | $343,943 | | $63,228 |
| | Hot or warm blast mixed charcoal and coke— | | | | | |
| 103 | Tons | 52,992 | | 640 | | |
| 104 | Value | $798,865 | | $10,249 | | |
| | Anthracite coal— | | | | | |
| 105 | Tons | 45,857 | | | | |
| 106 | Value | $612,702 | | | | |
| | Mixed anthracite coal and coke— | | | | | |
| 107 | Tons | 1,796,000 | | | | 15,081 |
| 108 | Value | $26,066,003 | | | | $233,902 |
| | Coke and bituminous coal— | | | | | |
| 109 | Tons | 12,253,818 | 1,153,674 | 1,782 | 1,469,530 | 223,735 |
| 110 | Value | $173,763,091 | $12,645,970 | $32,079 | $15,033,696 | $2,763,740 |
| 111 | Amount received for custom work and repairing | $143,862 | | | $112,450 | |
| 112 | Value of all other products | $99,940 | | $5,328 | $7,500 | $11,876 |
| | Pig iron, classified by grades: | | | | | |
| 113 | Total tons | 14,447,791 | 1,203,277 | 21,505 | 1,469,530 | 241,172 |
| 114 | Bessemer and low-phosphorus, tons | 8,475,530 | | | 1,320,287 | 218,691 |
| 115 | Basic, tons | 937,439 | 89,746 | | | |
| 116 | Foundry, tons | 3,510,300 | 883,208 | 18,870 | 94,008 | 5,064 |
| 117 | Forge, tons | 1,057,616 | 171,298 | 1,593 | 7,500 | 1,400 |
| 118 | White and mottled, and miscellaneous, tons | 208,323 | 56,561 | 1,042 | | 400 |
| 119 | Ferrosilicon, tons | 35,910 | | | | |
| 120 | Spiegeleisen, tons | [4]163,672 | | | 47,688 | 15,625 |
| 121 | Ferromanganese, tons | 51,878 | | | | |
| 122 | Direct castings, tons | 7,123 | 2,464 | | 47 | |
| | Pig iron exported by manufacturers: | | | | | |
| 123 | Tons | 166,625 | 113,185 | | | |
| 124 | Value | $1,865,484 | $1,090,620 | | | |
| | Furnaces: | | | | | |
| | Completed— | | | | | |
| 125 | Number[5] | 343 | 37 | 3 | 17 | 6 |
| 126 | Daily capacity (in tons)[5] | 54,425 | 5,216 | 145 | 4,408 | 1,060 |
| | In course of construction— | | | | | |
| 127 | Number | 16 | 2 | | 3 | |
| 128 | Daily capacity (in tons) | 7,275 | 400 | | 1,175 | |
| | Comparison of products: | | | | | |
| 129 | Number of establishments reporting for both years | 118 | 8 | | 2 | 2 |
| 130 | Value for census year | $146,840,104 | $10,736,317 | | $13,526,146 | $3,005,246 |
| 131 | Value for preceding business year | $98,079,811 | $6,665,530 | | $11,482,092 | $2,041,398 |
| | Power: | | | | | |
| 132 | Number of establishments reporting | 223 | 19 | 3 | 4 | 3 |
| 133 | Total horsepower | 505,965 | 59,377 | 1,295 | 35,975 | 6,960 |
| | Owned— | | | | | |
| | Engines— | | | | | |
| | Steam— | | | | | |
| 134 | Number | 1,294 | 172 | 6 | 31 | 43 |
| 135 | Horsepower | 494,798 | 58,844 | 1,200 | 34,920 | 6,660 |
| | Gas or gasoline— | | | | | |
| 136 | Number | 8 | | 3 | | |
| 137 | Horsepower | 122 | | 75 | | |
| | Water wheels— | | | | | |
| 138 | Number | 14 | | | | |
| 139 | Horsepower | 582 | | | | |
| | Electric motors— | | | | | |
| 140 | Number | 227 | 8 | 1 | 8 | 11 |
| 141 | Horsepower | 8,693 | 533 | 20 | 455 | 270 |
| | Other power— | | | | | |
| 142 | Number | 55 | | | 30 | |
| 143 | Horsepower | 1,770 | | | 600 | |
| 144 | Furnished to other establishments, horsepower | 925 | 25 | | | |
| | Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | |
| 145 | Total number of establishments | 223 | 19 | 3 | 4 | 3 |
| 146 | 5 to 20 | 3 | | | | |
| 147 | 21 to 50 | 16 | | 1 | | 1 |
| 148 | 51 to 100 | 38 | 3 | 1 | | 1 |
| 149 | 101 to 250 | 108 | 7 | | 1 | |
| 150 | 251 to 500 | 35 | 4 | 1 | 1 | |
| 151 | 501 to 1,000 | 17 | 4 | | 1 | 1 |
| 152 | Over 1,000 | 6 | 1 | | 1 | |

[1] The figures for the various items in this table do not agree with the corresponding figures for 1900 in all other tables, because the figures for a blast furnace in Texas, operated by a penal institution, have been excluded. This institution reported $170,000 invested as capital, 6 salaried employees who were paid $4,800, 112 wage-earners who received $16,062. Materials costing $33,769 were used, and 4,443 tons of charcoal foundry pig iron, valued at $66,645, were produced. This furnace has a daily capacity of 25 gross tons.

[2] Includes establishments distributed as follows: Colorado, 1; Connecticut, 1; Kentucky, 1; Massachusetts, 1; Minnesota, 1; Missouri, 2; North Carolina, 2; Texas, 3

DETAILED SUMMARY, BY STATES, 1900[1]—Continued.

is the gross ton of 2,240 pounds.]

| Michigan. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[2] | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15,354 | 92,869 | 180,353 | 1,252,632 | 3,371,405 | 205,810 | 437,508 | 83,535 | 99,937 | 224,105 | 81 |
| $13,681 | $59,281 | $114,090 | $1,003,919 | $2,264,666 | $109,974 | $228,207 | $84,216 | $64,079 | $147,665 | 82 |
| ..... | 101,804 | 15,267 | ..... | 765,707 | ..... | ..... | ..... | ..... | ..... | 83 |
| ..... | $811,209 | $57,491 | ..... | $1,913,385 | ..... | ..... | ..... | ..... | ..... | 84 |
| ..... | 3,006 | 15,781 | 256,018 | 257,194 | 15,235 | 9,776 | 17,433 | 3,154 | 107,042 | 85 |
| ..... | $7,582 | $28,778 | $396,211 | $255,313 | $20,167 | $12,960 | $15,690 | $8,341 | $156,732 | 86 |
| ..... | 127,078 | 328,091 | 2,604,811 | 6,254,301 | 569,070 | 638,078 | 178,701 | 183,680 | 407,009 | 87 |
| ..... | $450,138 | $1,123,255 | $6,869,925 | $15,576,340 | $1,412,961 | $1,638,905 | $513,696 | $775,709 | $1,167,130 | 88 |
| 11,519,298 | ..... | 844,799 | 987,215 | 787,606 | 2,672,865 | 239,053 | ..... | 2,793,609 | 3,322,861 | 89 |
| $743,410 | ..... | $69,696 | $43,457 | $47,256 | $124,361 | $14,143 | ..... | $164,447 | $193,001 | 90 |
| ..... | 51,098 | 8,820 | 192,203 | 1,108,607 | 18,892 | 9,115 | 16,422 | 19,363 | 48,951 | 91 |
| ..... | $59,665 | $13,541 | $463,347 | $2,686,748 | $44,747 | $16,995 | $50,137 | $33,225 | $105,997 | 92 |
| $8,490 | $48,807 | $31,282 | $162,958 | $855,551 | $78,388 | $96,084 | $4,898 | $9,283 | $58,310 | 93 |
| $6,917 | $34,710 | $77,498 | $233,057 | $510,089 | $29,902 | $62,335 | $54,599 | $33,886 | $19,772 | 94 |
| $184,533 | $239,160 | $508,041 | $2,166,118 | $4,943,756 | $178,350 | $603,555 | ..... | $288,721 | $222,508 | 95 |
| $2,327,153 | $2,546,215 | $5,046,145 | $40,366,637 | $101,575,487 | $4,693,215 | $6,505,218 | $3,119,301 | $2,900,237 | $5,571,189 | 96 |
| 141,377 | 150,002 | 334,512 | 2,559,694 | 6,778,584 | 374,249 | 428,117 | 188,292 | 217,451 | 340,029 | 97 |
| $2,327,153 | $2,521,066 | $5,042,550 | $40,308,758 | $101,555,787 | $4,693,215 | $6,505,218 | $3,119,301 | $2,899,912 | $5,571,189 | 98 |
| ..... | ..... | ..... | 1,500 | 4,341 | 3,981 | 1,616 | ..... | 630 | ..... | 99 |
| ..... | ..... | ..... | $33,000 | $120,383 | $65,686 | $45,248 | ..... | $12,600 | ..... | 100 |
| 141,377 | ..... | 7,443 | 4,751 | ..... | ..... | ..... | ..... | 34,580 | 27,913 | 101 |
| $2,327,153 | ..... | $185,991 | $102,350 | ..... | ..... | ..... | ..... | $517,950 | $612,763 | 102 |
| ..... | ..... | ..... | 800 | ..... | 51,552 | ..... | ..... | ..... | ..... | 103 |
| ..... | ..... | ..... | $18,000 | ..... | $770,616 | ..... | ..... | ..... | ..... | 104 |
| ..... | ..... | ..... | ..... | 45,857 | ..... | ..... | ..... | ..... | ..... | 105 |
| ..... | ..... | ..... | ..... | $612,702 | ..... | ..... | ..... | ..... | ..... | 106 |
| ..... | 148,582 | 64,521 | ..... | 1,567,866 | ..... | ..... | ..... | ..... | ..... | 107 |
| ..... | $2,506,408 | $1,154,175 | ..... | $22,171,518 | ..... | ..... | ..... | ..... | ..... | 108 |
| ..... | 1,470 | 262,548 | 2,552,643 | 5,160,520 | 318,716 | 426,501 | 188,292 | 182,291 | 312,116 | 109 |
| ..... | $14,658 | $3,702,384 | $40,155,408 | $78,651,184 | $3,856,913 | $6,459,970 | $3,119,301 | $2,369,362 | $4,958,426 | 110 |
| ..... | ..... | ..... | $29,658 | $1,754 | ..... | ..... | ..... | ..... | ..... | 111 |
| ..... | $25,149 | $8,595 | $28,221 | $17,946 | ..... | ..... | ..... | $325 | ..... | 112 |
| 141,377 | 150,002 | 334,512 | 2,559,694 | 6,778,584 | 374,249 | 428,117 | 188,292 | 217,451 | 340,029 | 113 |
| ..... | 25,575 | ..... | 1,862,136 | 4,617,969 | 11,643 | ..... | 188,292 | 75,748 | 155,184 | 114 |
| ..... | ..... | ..... | 93,700 | 666,589 | 802 | 72,981 | ..... | ..... | 13,621 | 115 |
| 186,741 | 61,840 | 291,993 | 305,004 | 856,472 | 287,655 | 304,466 | ..... | 135,796 | 129,191 | 116 |
| ..... | 34,634 | 38,699 | 246,487 | 446,328 | 54,182 | 28,661 | ..... | 3,135 | 23,699 | 117 |
| 4,636 | 6,079 | 3,416 | 33,347 | 50,077 | 19,962 | 21,807 | ..... | 2,772 | 8,224 | 118 |
| ..... | ..... | ..... | 19,020 | 10,190 | ..... | ..... | ..... | ..... | 6,700 | 119 |
| ..... | 21,824 | ..... | ..... | [5]75,135 | ..... | ..... | ..... | ..... | 3,400 | 120 |
| ..... | ..... | 404 | ..... | 51,474 | ..... | ..... | ..... | ..... | ..... | 121 |
| ..... | 50 | ..... | ..... | 4,350 | ..... | 202 | ..... | ..... | 10 | 122 |
| 3,088 | 12,000 | 17,156 | 8,055 | 1,298 | ..... | 2,027 | ..... | 9,676 | 140 | 123 |
| $67,110 | $214,000 | $246,587 | $92,096 | $15,798 | ..... | $29,157 | ..... | $107,376 | $2,740 | 124 |
| 7 | 10 | 12 | 51 | 136 | 17 | 19 | 3 | 6 | 19 | 125 |
| 480 | 787 | 1,690 | 10,468 | 23,497 | 1,970 | 1,907 | 750 | 750 | 1,357 | 126 |
| ..... | 1 | ..... | 4 | 5 | ..... | ..... | ..... | ..... | 1 | 127 |
| ..... | 400 | ..... | 2,200 | 2,700 | ..... | ..... | ..... | ..... | 400 | 128 |
| 6 | 4 | 4 | 26 | 43 | 6 | 7 | 3 | 2 | 5 | 129 |
| $2,188,847 | $1,788,615 | $2,941,417 | $21,948,864 | $75,764,672 | $3,053,816 | $3,802,780 | $3,119,301 | $1,637,503 | $3,876,580 | 130 |
| $1,800,655 | $1,264,787 | $2,481,734 | $12,211,764 | $51,182,789 | $1,870,096 | $1,610,613 | $1,985,643 | $1,175,075 | $2,307,745 | 131 |
| 7 | 9 | 9 | 43 | 77 | 18 | 16 | 3 | 5 | 12 | 132 |
| 2,704 | 6,890 | 15,418 | 97,915 | 221,481 | 13,510 | 21,655 | 4,236 | 4,185 | 14,414 | 133 |
| 31 | 45 | 36 | 249 | 495 | 47 | 61 | 13 | 16 | 50 | 134 |
| 2,554 | 6,830 | 14,943 | 95,040 | 216,214 | 13,350 | 21,490 | 4,236 | 4,160 | 14,327 | 135 |
| ..... | ..... | ..... | ..... | ..... | ..... | 4 | ..... | ..... | 1 | 136 |
| ..... | ..... | ..... | ..... | ..... | ..... | 40 | ..... | ..... | 7 | 137 |
| 3 | 1 | ..... | ..... | 7 | ..... | 1 | ..... | ..... | 2 | 138 |
| 150 | 15 | ..... | ..... | 262 | ..... | 75 | ..... | ..... | 80 | 139 |
| ..... | 2 | 2 | 66 | 123 | 4 | 1 | ..... | 1 | ..... | 140 |
| ..... | 45 | 155 | 2,875 | 4,105 | 160 | 50 | ..... | 25 | ..... | 141 |
| ..... | ..... | 11 | ..... | 14 | ..... | ..... | ..... | ..... | ..... | 142 |
| ..... | ..... | 320 | ..... | 850 | ..... | ..... | ..... | ..... | ..... | 143 |
| 400 | ..... | ..... | ..... | 500 | ..... | ..... | ..... | ..... | ..... | 144 |
| 7 | 9 | 9 | 43 | 77 | 18 | 16 | 3 | 5 | 12 | 145 |
| ..... | ..... | 2 | ..... | 1 | ..... | ..... | ..... | ..... | ..... | 146 |
| 3 | ..... | ..... | 4 | 2 | 1 | 1 | ..... | ..... | 3 | 147 |
| 1 | 5 | 1 | 7 | 9 | 3 | 4 | ..... | 2 | 1 | 148 |
| 3 | 4 | 4 | 25 | 88 | 7 | 9 | 3 | 3 | 4 | 149 |
| ..... | ..... | 2 | 5 | 15 | 1 | 2 | ..... | ..... | 4 | 150 |
| ..... | ..... | ..... | 2 | 8 | 1 | ..... | ..... | ..... | ..... | 151 |
| ..... | ..... | ..... | ..... | 4 | ..... | ..... | ..... | ..... | ..... | 152 |

[3] Includes 7,128 tons of castings produced direct from furnace, valued at $87,662; and 215,550 tons of spiegeleisen and ferromanganese, valued at $6,871,955, distributed as follows: Direct castings—Alabama, 2,464 tons; Illinois, 47 tons; Missouri, 10 tons; New Jersey, 50 tons; Pennsylvania, 4,350 tons; Virginia, 202 tons. Spiegeleisen and ferromanganese—Colorado, 3,400 tons; Illinois, 47,688 tons; Maryland, 15,625 tons; New Jersey, 21,824 tons; New York, 404 tons; Pennsylvania, 126,609 tons.

[4] Includes 355 tons, silico-spiegel.

[5] Includes 18 idle furnaces owned by active establishments.

TABLE 71, PART II.—BLAST FURNACES: CAPITAL, EQUIPMENT, DAILY CAPACITY,

[The ton when used as a unit of measure

| | | IDLE ESTABLISHMENTS. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | United States. | Alabama. | Connecticut. | Georgia. | Kentucky. | Maryland. | Michigan. | New Jersey. | New York. |
| 1 | Number of establishments | 49 | 7 | 3 | 2 | 1 | 1 | 6 | 1 | 4 |
| | Character of organization: | | | | | | | | | |
| 2 | Individual | 8 | ..... | ..... | ..... | ..... | ..... | 1 | ..... | 1 |
| 3 | Firm and limited partnership | 4 | 1 | ..... | ..... | ..... | ..... | ..... | ..... | 1 |
| 4 | Incorporated company | 37 | 6 | 3 | 2 | 1 | 1 | 5 | 1 | 2 |
| | Capital: | | | | | | | | | |
| 5 | Total | $9,935,445 | $1,975,258 | $139,111 | $551,300 | $25,000 | $165,434 | $688,981 | $500,000 | $1,558,000 |
| 6 | Land | $2,691,871 | $583,767 | $28,755 | $293,300 | ..... | $100,000 | $88,984 | $242,533 | $130,000 |
| 7 | Buildings | $5,473,309 | $1,018,000 | $96,000 | $215,000 | ..... | $6,000 | $105,219 | $237,467 | $1,245,000 |
| 8 | Machinery, tools, and implements | $1,245,306 | $346,714 | $3,400 | $43,000 | ..... | $294 | $284,117 | $20,000 | $163,000 |
| 9 | Cash and sundries | $524,959 | $26,777 | $10,956 | ..... | $25,000 | $59,140 | $210,661 | ..... | $20,000 |
| | Rented property: | | | | | | | | | |
| 10 | Total | $191,000 | ..... | ..... | ..... | $145,000 | ..... | ..... | ..... | ..... |
| 11 | Land | $41,000 | ..... | ..... | ..... | $20,000 | ..... | ..... | ..... | ..... |
| 12 | Buildings | $120,000 | ..... | ..... | ..... | $100,000 | ..... | ..... | ..... | ..... |
| 13 | Machinery, tools, and implements | $30,000 | ..... | ..... | ..... | $25,000 | ..... | ..... | ..... | ..... |
| | Furnaces: | | | | | | | | | |
| 14 | Number | 55 | 8 | 3 | 2 | 1 | 1 | 6 | 1 | 7 |
| 15 | Daily capacity, tons | 4,119 | 887 | 45 | 155 | 75 | 30 | 450 | 80 | 890 |
| | Power: | | | | | | | | | |
| 16 | Number of establishments reporting | 47 | 6 | 3 | 2 | 1 | 1 | 5 | 1 | 4 |
| 17 | Total horsepower | 25,756 | 6,710 | 165 | 1,100 | 494 | 60 | 940 | 100 | 6,035 |
| | Owned— | | | | | | | | | |
| | Engines— | | | | | | | | | |
| | Steam— | | | | | | | | | |
| 18 | Number | 102 | 20 | ..... | 4 | 1 | 1 | 12 | 1 | 19 |
| 19 | Horsepower | 25,433 | 6,710 | ..... | 1,100 | 494 | 60 | 940 | 100 | 5,985 |
| | Water wheels— | | | | | | | | | |
| 20 | Number | 8 | ..... | 4 | ..... | ..... | ..... | ..... | ..... | 1 |
| 21 | Horsepower | 323 | ..... | 165 | ..... | ..... | ..... | ..... | ..... | 50 |

AND POWER OF IDLE AND BUILDING ESTABLISHMENTS, BY STATES: 1900.

is the gross ton of 2,240 pounds.]

| IDLE ESTABLISHMENTS—continued. | | | | | | | BUILDING ESTABLISHMENTS. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ohio. | Oregon. | Pennsylvania. | Tennessee. | Texas. | Virginia. | Washington. | United States. | New York. | Ohio. | Pennsylvania. | Tennessee. | |
| 2 | 1 | 10 | 2 | 1 | 7 | 1 | 5 | 1 | 1 | 2 | 1 | 1 |
| ..... | ..... | 4 | ..... | 1 | 1 | ..... | ..... | ..... | ..... | ..... | ..... | 2 |
| ..... | ..... | 2 | ..... | ..... | ..... | ..... | 1 | ..... | ..... | 1 | ..... | 3 |
| 2 | 1 | 4 | 2 | ..... | 6 | 1 | 4 | 1 | 1 | 1 | 1 | 4 |
| $35,000 | $686,993 | $1,326,088 | $450,000 | $274,000 | $1,091,624 | $468,656 | $1,021,775 | $100,000 | $450,000 | $86,775 | $385,000 | 5 |
| $13,000 | $148,449 | $315,500 | $200,000 | $75,000 | $288,000 | $184,583 | $19,000 | ..... | $17,500 | $600 | $1,000 | 6 |
| $2,000 | $363,930 | $836,588 | $230,000 | $185,000 | $661,000 | $272,105 | $814,050 | $70,000 | $350,000 | $10,050 | $384,000 | 7 |
| $1,000 | $174,024 | $35,100 | $20,000 | $10,000 | $83,124 | $11,533 | $57,525 | $25,000 | $32,500 | $25 | ..... | 8 |
| $19,000 | $590 | $88,900 | ..... | $4,000 | $59,500 | $435 | $131,200 | $5,000 | $50,000 | $76,200 | ..... | 9 |
| $45,000 | ..... | $1,000 | ..... | ..... | ..... | ..... | $4,700 | $4,700 | ..... | ..... | ..... | 10 |
| $20,000 | ..... | $1,000 | ..... | ..... | ..... | ..... | $4,700 | $4,700 | ..... | ..... | ..... | 11 |
| $20,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 12 |
| $5,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13 |
| 2 | 1 | 12 | 2 | 1 | 7 | 1 | [1]6 | 1 | 2 | 2 | 1 | 14 |
| 32 | 50 | 573 | 300 | 50 | 467 | 35 | 1,414 | 100 | 330 | 604 | 380 | 15 |
| 2 | 1 | 10 | 2 | 1 | 7 | 1 | ..... | ..... | ..... | ..... | ..... | 16 |
| 410 | 760 | 3,002 | 400 | 200 | 5,080 | 300 | ..... | ..... | ..... | ..... | ..... | 17 |
| 2 | 5 | 17 | 2 | 1 | 14 | 3 | ..... | ..... | ..... | ..... | ..... | 18 |
| 410 | 760 | 2,894 | 400 | 200 | 5,080 | 300 | ..... | ..... | ..... | ..... | ..... | 19 |
| ..... | ..... | 3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 20 |
| ..... | ..... | 108 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 21 |

[1] In addition, 16 furnaces, with a daily capacity of 7,350 tons, were being erected by establishments which operated blast furnaces during the census year. The total number of new furnaces which were in course of construction on May 31, 1900, was, therefore, 22, with a daily capacity of 8,764 tons.

TABLE 72, PART I.—ROLLING MILLS AND STEEL WORKS:

[The ton when used as a unit of measure

| | | United States. | Alabama. | California. | Connecticut. | Delaware. | Illinois. | Indiana. | Kentucky. | Maryland. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Number of establishments[2] | 438 | 6 | 3 | 7 | 6 | 22 | 27 | 6 | 5 |
| | Character of organization: | | | | | | | | | |
| 2 | Individual | 11 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 3 | Firm and limited partnership | 40 | ..... | ..... | ..... | ..... | 1 | 1 | ..... | ..... |
| 4 | Incorporated company | 387 | 6 | 3 | 7 | 6 | 21 | 26 | 6 | 5 |
| | Capital: | | | | | | | | | |
| 5 | Total | $429,960,043 | $4,326,295 | $1,499,162 | $4,792,902 | $4,207,079 | $32,591,826 | $14,994,210 | $3,134,287 | $1,365,001 |
| 6 | Land | $36,157,122 | $125,000 | $480,500 | $383,105 | $555,000 | $6,067,544 | $1,078,500 | $151,998 | $26,000 |
| 7 | Buildings | $47,203,829 | $266,239 | $104,500 | $503,427 | $384,500 | $3,868,030 | $1,558,912 | $393,000 | $348,966 |
| 8 | Machinery, tools, and implements | $151,870,578 | $2,060,295 | $565,000 | $1,589,416 | $2,188,522 | $11,538,334 | $6,991,201 | $1,092,857 | $694,516 |
| 9 | Cash and sundries | $194,728,514 | $1,874,761 | $349,162 | $2,316,954 | $1,129,057 | $11,117,918 | $5,365,597 | $1,496,432 | $295,519 |
| | Rented property: | | | | | | | | | |
| 10 | Total | $11,835,940 | $75,000 | ..... | ..... | ..... | $80,500 | ..... | ..... | $682,313 |
| 11 | Land | $2,660,423 | $7,500 | ..... | ..... | ..... | $55,000 | ..... | ..... | $32,313 |
| 12 | Buildings | $2,458,197 | $37,500 | ..... | ..... | ..... | $25,500 | ..... | ..... | $553,000 |
| 13 | Machinery, tools, and implements | $6,717,320 | $30,000 | ..... | ..... | ..... | ..... | ..... | ..... | $97,000 |
| 14 | Proprietors and firm members | 119 | ..... | ..... | ..... | ..... | 3 | ..... | ..... | ..... |
| | Salaried officials, clerks, etc.: | | | | | | | | | |
| 15 | Total number | 7,442 | 34 | 18 | 72 | 81 | 570 | 205 | 73 | 40 |
| 16 | Total salaries | $9,421,868 | $55,548 | $32,250 | $107,775 | $132,677 | $631,567 | $266,764 | $91,669 | $58,499 |
| | Officers of corporations— | | | | | | | | | |
| 17 | Number | 747 | 4 | 3 | 16 | 18 | 34 | 28 | 20 | 9 |
| 18 | Salaries | $2,789,090 | $15,500 | $9,700 | $46,516 | $51,208 | $152,900 | $99,479 | $40,430 | $22,738 |
| | General superintendents, managers, clerks, etc.— | | | | | | | | | |
| 19 | Total number | 6,695 | 30 | 15 | 56 | 63 | 536 | 177 | 53 | 31 |
| 20 | Total salaries | $6,632,778 | $40,048 | $12,550 | $61,259 | $81,469 | $478,667 | $167,285 | $51,239 | $35,761 |
| | Men— | | | | | | | | | |
| 21 | Number | 6,389 | 30 | 12 | 49 | 56 | 492 | 172 | 50 | 30 |
| 22 | Salaries | $6,486,557 | $40,048 | $11,350 | $59,041 | $78,933 | $458,021 | $164,824 | $49,819 | $35,516 |
| | Women— | | | | | | | | | |
| 23 | Number | 306 | ..... | 3 | 7 | 7 | 44 | 5 | 3 | 1 |
| 24 | Salaries | $146,221 | ..... | $1,200 | $2,218 | $2,536 | $20,646 | $2,461 | $1,420 | $245 |
| | Wage-earners, including pieceworkers, and total wages: | | | | | | | | | |
| 25 | Greatest number employed at any one time during the year. | 219,538 | 2,837 | 791 | 1,970 | 1,646 | 16,177 | 9,803 | 2,068 | 1,767 |
| 26 | Least number employed at any one time during the year. | 153,602 | 1,940 | 660 | 1,517 | 1,121 | 11,566 | 5,010 | 1,429 | 988 |
| 27 | Average number | 188,023 | 2,204 | 555 | 1,785 | 1,490 | 13,632 | 7,579 | 1,766 | 1,419 |
| 28 | Wages | $102,238,692 | $1,072,384 | $327,184 | $939,243 | $705,366 | $7,464,442 | $4,248,831 | $949,047 | $703,445 |
| | Men, 16 years and over— | | | | | | | | | |
| 29 | Average number | 180,148 | 2,180 | 539 | 1,770 | 1,481 | 13,293 | 7,427 | 1,751 | 1,384 |
| 30 | Wages | $101,579,174 | $1,069,866 | $323,862 | $935,883 | $704,166 | $7,374,717 | $4,204,888 | $946,127 | $693,588 |
| | Women, 16 years and over— | | | | | | | | | |
| 31 | Average number | 1,065 | ..... | 4 | 12 | ..... | 146 | 72 | ..... | 12 |
| 32 | Wages | $265,536 | ..... | $1,000 | $2,587 | ..... | $43,605 | $15,927 | ..... | $3,000 |
| | Children, under 16 years— | | | | | | | | | |
| 33 | Average number | 1,810 | 24 | 12 | 3 | 9 | 193 | 80 | 15 | 23 |
| 34 | Wages | $393,982 | $2,518 | $2,322 | $773 | $1,200 | $46,120 | $23,016 | $2,920 | $6,857 |
| | Average number of wage-earners, including pieceworkers, employed during each month: | | | | | | | | | |
| | Men, 16 years and over— | | | | | | | | | |
| 35 | January | 173,687 | 2,374 | 495 | 1,746 | 1,470 | 12,930 | 8,549 | 1,514 | 1,451 |
| 36 | February | 177,948 | 2,386 | 495 | 1,720 | 1,515 | 12,662 | 7,617 | 1,427 | 1,089 |
| 37 | March | 182,866 | 2,586 | 495 | 1,728 | 1,501 | 13,527 | 7,455 | 1,581 | 1,541 |
| 38 | April | 179,158 | 2,684 | 495 | 1,753 | 1,481 | 12,773 | 6,999 | 1,675 | 1,498 |
| 39 | May | 179,895 | 2,129 | 495 | 1,744 | 1,441 | 13,104 | 7,343 | 1,782 | 1,516 |
| 40 | June | 176,562 | 2,516 | 669 | 1,768 | 1,363 | 13,308 | 7,242 | 1,741 | 1,359 |
| 41 | July | 166,074 | 1,789 | 686 | 1,676 | 1,383 | 12,623 | 5,857 | 1,834 | 1,330 |
| 42 | August | 179,291 | 1,807 | 668 | 1,787 | 1,409 | 13,551 | 6,946 | 1,880 | 1,549 |
| 43 | September | 186,223 | 1,781 | 490 | 1,798 | 1,519 | 13,772 | 7,109 | 1,849 | 1,506 |
| 44 | October | 188,924 | 1,853 | 495 | 1,826 | 1,538 | 13,994 | 7,921 | 1,868 | 1,386 |
| 45 | November | 188,214 | 1,881 | 495 | 1,837 | 1,581 | 13,725 | 8,443 | 1,933 | 1,159 |
| 46 | December | 182,991 | 2,374 | 495 | 1,854 | 1,569 | 13,547 | 7,639 | 1,927 | 1,222 |
| | Women, 16 years and over— | | | | | | | | | |
| 47 | January | 1,072 | ..... | 5 | 13 | ..... | 147 | 81 | ..... | 12 |
| 48 | February | 1,046 | ..... | 5 | 13 | ..... | 122 | 67 | ..... | 12 |
| 49 | March | 1,061 | ..... | 5 | 13 | ..... | 138 | 66 | ..... | 12 |
| 50 | April | 1,040 | ..... | 5 | 13 | ..... | 135 | 52 | ..... | 12 |
| 51 | May | 1,038 | ..... | 4 | 13 | ..... | 130 | 65 | ..... | 12 |
| 52 | June | 1,077 | ..... | 3 | 13 | ..... | 172 | 72 | ..... | 12 |
| 53 | July | 1,016 | ..... | 3 | 6 | ..... | 147 | 52 | ..... | 12 |
| 54 | August | 1,089 | ..... | 3 | 13 | ..... | 147 | 87 | ..... | 12 |
| 55 | September | 1,106 | ..... | 3 | 13 | ..... | 157 | 93 | ..... | 12 |
| 56 | October | 1,103 | ..... | 3 | 13 | ..... | 156 | 88 | ..... | 12 |
| 57 | November | 1,082 | ..... | 3 | 13 | ..... | 150 | 85 | ..... | 9 |
| 58 | December | 1,054 | ..... | 3 | 13 | ..... | 149 | 57 | ..... | 9 |
| | Children, under 16 years— | | | | | | | | | |
| 59 | January | 1,758 | 27 | 10 | 4 | 6 | 178 | 88 | 25 | 28 |
| 60 | February | 1,740 | 29 | 10 | 4 | 6 | 198 | 84 | 25 | 28 |
| 61 | March | 1,797 | 26 | 10 | 4 | 10 | 201 | 84 | 22 | 28 |
| 62 | April | 1,790 | 30 | 10 | 4 | 10 | 206 | 84 | 4 | 28 |
| 63 | May | 1,918 | 26 | 10 | 3 | 10 | 213 | 90 | 4 | 28 |
| 64 | June | 1,777 | 29 | 17 | 3 | 10 | 164 | 90 | 4 | 28 |
| 65 | July | 1,622 | 18 | 17 | 3 | 8 | 182 | 48 | 4 | 25 |
| 66 | August | 1,919 | 21 | 17 | 3 | 9 | 203 | 84 | 4 | 28 |
| 67 | September | 1,920 | 18 | 10 | 3 | 7 | 203 | 84 | 4 | 28 |
| 68 | October | 1,957 | 18 | 10 | 3 | 10 | 207 | 84 | 32 | 28 |
| 69 | November | 1,860 | 18 | 10 | 3 | 8 | 184 | 91 | 26 | 3 |
| 70 | December | 1,670 | 28 | 10 | 3 | 10 | 180 | 52 | 24 | 2 |
| | Miscellaneous expenses: | | | | | | | | | |
| 71 | Total | $24,795,663 | $107,737 | $18,944 | $188,313 | $140,054 | $2,516,516 | $376,844 | $120,818 | $351,622 |
| 72 | Rent of works | $930,500 | ..... | ..... | ..... | ..... | $6,000 | ..... | ..... | $2,000 |
| 73 | Taxes, not including internal revenue | $1,128,347 | $10,112 | $5,036 | $19,681 | $8,017 | $83,239 | $29,498 | $6,246 | $17,896 |
| 74 | Rent of offices, interest, insurance, and all sundry expenses not hitherto included. | $22,189,600 | $97,625 | $13,908 | $168,632 | $132,037 | $2,427,277 | $347,202 | $114,572 | $331,726 |
| 75 | Contract work | $547,216 | ..... | ..... | ..... | ..... | ..... | $144 | ..... | ..... |

[1] Includes establishments distributed as follows: Colorado, 2; Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.

DETAILED SUMMARY, BY STATES, 1900.

is the gross ton of 2,240 pounds.]

| Massachusetts. | Michigan. | Missouri. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 | 5 | 16 | 20 | 64 | 209 | 3 | 4 | 8 | 7 | 10 | 1 |
| 1 | ..... | ..... | 1 | 1 | ..... | 7 | 1 | ..... | ..... | ..... | ..... | 2 |
| ..... | ..... | ..... | ..... | 5 | 1 | 32 | ..... | ..... | ..... | ..... | ..... | 3 |
| 6 | 3 | 5 | 15 | 14 | 63 | 170 | 2 | 4 | 8 | 7 | 10 | 4 |
| $13,608,604 | $1,829,337 | $1,946,309 | $17,716,970 | $8,742,471 | $63,181,422 | $237,129,032 | $129,570 | $1,903,944 | $7,122,357 | $3,927,814 | $5,811,451 | 5 |
| $409,800 | $75,000 | $333,107 | $1,526,908 | $1,462,563 | $4,174,772 | $16,829,084 | $11,500 | $890,000 | $731,443 | $613,483 | $241,815 | 6 |
| $992,500 | $146,333 | $305,636 | $1,530,623 | $1,378,978 | $7,619,980 | $25,088,954 | $21,300 | $85,000 | $1,500,560 | $398,482 | $707,909 | 7 |
| $4,705,130 | $567,380 | $506,173 | $3,122,454 | $2,411,554 | $28,276,612 | $78,860,018 | $50,770 | $439,042 | $2,186,175 | $730,713 | $3,344,416 | 8 |
| $7,501,174 | $1,040,624 | $801,393 | $11,536,985 | $3,499,376 | $23,110,058 | $116,350,976 | $46,000 | $489,902 | $2,704,179 | $2,185,136 | $1,517,811 | 9 |
| ..... | $75,000 | $249,000 | $145,000 | $501,000 | ..... | $9,872,736 | ..... | $10,000 | ..... | $98,750 | $46,641 | 10 |
| ..... | $75,000 | $249,000 | $105,000 | $211,000 | ..... | $1,859,100 | ..... | $10,000 | ..... | $55,750 | $760 | 11 |
| ..... | ..... | ..... | $40,000 | $135,000 | ..... | $1,610,247 | ..... | ..... | ..... | $43,000 | $13,950 | 12 |
| ..... | ..... | ..... | ..... | $155,000 | ..... | $6,403,389 | ..... | ..... | ..... | ..... | $31,931 | 13 |
| ..... | ..... | ..... | 1 | 15 | ..... | 99 | 1 | ..... | ..... | ..... | ..... | 14 |
| 93 | 28 | 52 | 282 | 191 | 945 | 4,450 | 15 | 34 | 81 | 65 | 113 | 15 |
| $155,217 | $80,625 | $81,566 | $452,357 | $293,867 | $1,250,230 | $5,390,828 | $14,986 | $61,905 | $108,426 | $73,624 | $141,488 | 16 |
| 6 | 7 | 11 | 38 | 24 | 105 | 379 | 3 | 4 | 10 | 9 | 19 | 17 |
| $71,677 | $7,300 | $30,382 | $134,884 | $99,381 | $497,995 | $1,364,701 | $8,000 | $10,831 | $41,050 | $20,861 | $63,567 | 18 |
| 87 | 21 | 41 | 244 | 167 | 840 | 4,071 | 12 | 30 | 71 | 56 | 94 | 19 |
| $83,540 | $23,825 | $51,184 | $317,478 | $194,486 | $752,235 | $4,026,127 | $6,986 | $51,074 | $67,376 | $52,763 | $77,931 | 20 |
| 74 | 19 | 38 | 232 | 154 | 796 | 3,940 | 11 | 28 | 69 | 53 | 84 | 21 |
| $77,053 | $22,510 | $49,204 | $311,892 | $186,772 | $782,384 | $3,959,955 | $6,486 | $50,006 | $66,944 | $52,243 | $78,556 | 22 |
| 13 | 2 | 3 | 12 | 13 | 44 | 131 | 1 | 2 | 2 | 3 | 10 | 23 |
| $6,487 | $815 | $1,980 | $5,581 | $7,714 | $19,851 | $66,172 | $500 | $1,068 | $432 | $520 | $4,375 | 24 |
| 6,898 | 1,551 | 1,891 | 8,641 | 5,538 | 32,906 | 113,896 | 222 | 1,886 | 4,523 | 1,606 | 2,921 | 25 |
| 5,295 | 1,196 | 1,395 | 6,869 | 3,275 | 21,706 | 81,589 | 144 | 1,139 | 3,700 | 1,155 | 1,908 | 26 |
| 6,099 | 1,459 | 1,604 | 7,699 | 4,344 | 27,638 | 94,664 | 216 | 1,503 | 3,975 | 1,370 | 2,022 | 27 |
| $3,401,995 | $725,061 | $881,917 | $3,600,728 | $2,410,275 | $16,443,825 | $53,817,488 | $100,375 | $452,020 | $2,066,289 | $909,117 | $1,024,660 | 28 |
| 5,905 | 1,459 | 1,589 | 7,458 | 4,292 | 27,467 | 93,277 | 213 | 1,503 | 3,830 | 1,370 | 1,960 | 29 |
| $3,340,806 | $725,061 | $878,331 | $3,542,494 | $2,400,192 | $16,409,958 | $53,522,871 | $100,025 | $452,020 | $2,031,634 | $909,117 | $1,013,068 | 30 |
| 171 | ..... | ..... | 176 | 34 | 128 | 305 | ..... | ..... | 5 | ..... | ..... | 31 |
| $54,544 | ..... | ..... | $49,214 | $7,308 | $24,258 | $62,293 | ..... | ..... | $1,800 | ..... | ..... | 32 |
| 23 | ..... | 15 | 65 | 18 | 43 | 1,082 | 3 | ..... | 140 | ..... | 62 | 33 |
| $6,645 | ..... | $3,086 | $9,020 | $2,775 | $9,609 | $232,324 | $350 | ..... | $32,855 | ..... | $11,592 | 34 |
| 6,247 | 1,550 | 1,543 | 6,950 | 4,620 | 27,894 | 85,818 | 213 | 1,308 | 3,923 | 1,140 | 1,907 | 35 |
| 6,412 | 1,520 | 1,553 | 7,077 | 4,626 | 28,605 | 90,900 | 213 | 1,397 | 3,694 | 1,210 | 1,825 | 36 |
| 6,353 | 1,475 | 1,649 | 7,115 | 4,694 | 28,141 | 94,786 | 215 | 1,425 | 3,911 | 1,271 | 1,917 | 37 |
| 6,423 | 1,465 | 1,543 | 7,363 | 4,460 | 26,263 | 93,296 | 214 | 1,432 | 4,043 | 1,363 | 1,935 | 38 |
| 6,139 | 1,525 | 1,547 | 7,582 | 4,289 | 27,235 | 92,745 | 212 | 1,375 | 4,161 | 1,516 | 2,015 | 39 |
| 5,386 | 1,454 | 1,480 | 7,351 | 3,996 | 27,366 | 90,946 | 211 | 1,337 | 3,649 | 1,356 | 2,064 | 40 |
| 5,107 | 1,275 | 1,499 | 7,336 | 3,488 | 24,011 | 88,362 | 219 | 1,325 | 3,099 | 1,376 | 1,799 | 41 |
| 5,272 | 1,295 | 1,588 | 7,329 | 2,832 | 27,290 | 95,035 | 217 | 1,439 | 4,170 | 1,426 | 1,801 | 42 |
| 5,531 | 1,375 | 1,591 | 7,802 | 4,175 | 28,547 | 97,882 | 213 | 1,602 | 4,111 | 1,453 | 2,117 | 43 |
| 5,966 | 1,545 | 1,669 | 7,936 | 4,742 | 28,420 | 98,163 | 211 | 1,748 | 4,022 | 1,413 | 2,208 | 44 |
| 6,000 | 1,525 | 1,711 | 7,879 | 4,776 | 28,162 | 97,980 | 211 | 1,786 | 3,621 | 1,456 | 2,053 | 45 |
| 6,027 | 1,505 | 1,697 | 7,773 | 4,807 | 27,667 | 93,922 | 213 | 1,863 | 3,560 | 1,457 | 1,873 | 46 |
| 172 | ..... | ..... | 151 | 43 | 141 | 301 | ..... | ..... | 6 | ..... | ..... | 47 |
| 175 | ..... | ..... | 158 | 49 | 138 | 301 | ..... | ..... | 6 | ..... | ..... | 48 |
| 177 | ..... | ..... | 158 | 54 | 131 | 301 | ..... | ..... | 6 | ..... | ..... | 49 |
| 164 | ..... | ..... | 178 | 39 | 136 | 300 | ..... | ..... | 6 | ..... | ..... | 50 |
| 159 | ..... | ..... | 182 | 29 | 138 | 300 | ..... | ..... | 6 | ..... | ..... | 51 |
| 173 | ..... | ..... | 183 | 21 | 127 | 301 | ..... | ..... | ..... | ..... | ..... | 52 |
| 177 | ..... | ..... | 181 | 19 | 103 | 316 | ..... | ..... | ..... | ..... | ..... | 53 |
| 174 | ..... | ..... | 179 | 24 | 129 | 315 | ..... | ..... | 6 | ..... | ..... | 54 |
| 175 | ..... | ..... | 181 | 24 | 134 | 308 | ..... | ..... | 6 | ..... | ..... | 55 |
| 173 | ..... | ..... | 186 | 32 | 123 | 311 | ..... | ..... | 6 | ..... | ..... | 56 |
| 170 | ..... | ..... | 187 | 34 | 114 | 311 | ..... | ..... | 6 | ..... | ..... | 57 |
| 169 | ..... | ..... | 189 | 38 | 125 | 296 | ..... | ..... | 6 | ..... | ..... | 58 |
| 21 | ..... | 14 | 66 | 18 | 51 | 1,012 | 3 | ..... | 138 | ..... | 69 | 59 |
| 21 | ..... | 14 | 40 | 18 | 50 | 1,011 | 3 | ..... | 130 | ..... | 69 | 60 |
| 21 | ..... | 15 | 35 | 17 | 33 | 1,075 | 3 | ..... | 143 | ..... | 70 | 61 |
| 28 | ..... | 14 | 36 | 17 | 35 | 1,059 | 3 | ..... | 154 | ..... | 68 | 62 |
| 29 | ..... | 13 | 77 | 17 | 45 | 1,119 | 3 | ..... | 160 | ..... | 71 | 63 |
| 19 | ..... | 16 | 76 | 17 | 49 | 1,037 | 3 | ..... | 163 | ..... | 52 | 64 |
| 20 | ..... | 15 | 80 | 18 | 37 | 968 | 3 | ..... | 121 | ..... | 55 | 65 |
| 20 | ..... | 15 | 77 | 18 | 47 | 1,195 | 3 | ..... | 158 | ..... | 17 | 66 |
| 26 | ..... | 14 | 77 | 21 | 47 | 1,165 | 3 | ..... | 150 | ..... | 60 | 67 |
| 25 | ..... | 20 | 76 | 18 | 43 | 1,162 | 3 | ..... | 147 | ..... | 71 | 68 |
| 23 | ..... | 17 | 80 | 18 | 41 | 1,145 | 3 | ..... | 111 | ..... | 79 | 69 |
| 20 | ..... | 19 | 62 | 18 | 36 | 1,031 | 3 | ..... | 104 | ..... | 68 | 70 |
| $989,570 | $146,780 | $72,378 | $1,056,865 | $211,984 | $3,184,600 | $14,578,593 | $12,158 | $87,915 | $166,378 | $252,093 | $271,001 | 71 |
| $15,000 | $3,750 | $3,650 | $6,166 | $25,481 | $198 | $863,924 | ..... | $2,300 | ..... | $2,080 | $1 | 72 |
| $71,556 | $10,165 | $10,646 | $48,526 | $44,033 | $153,964 | $542,173 | $2,493 | $11,188 | $26,462 | $13,921 | $13,500 | 73 |
| $903,014 | $132,865 | $58,082 | $1,001,673 | $136,428 | $2,980,438 | $12,626,516 | $9,665 | $74,432 | $139,916 | $236,092 | $257,500 | 74 |
| ..... | ..... | ..... | ..... | $6,092 | ..... | $540,980 | ..... | ..... | ..... | ..... | ..... | 75 |

[2] Includes only active establishments.

TABLE 72, PART I.—ROLLING MILLS AND STEEL WORKS:

[The ton when used as a unit of measure

| | | United States. | Alabama. | California. | Connecticut. | Delaware. | Illinois. | Indiana. | Kentucky. | Maryland. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Materials used: | | | | | | | | | |
| 76 | Total cost | $390,568,117 | $2,451,824 | $506,834 | $2,198,682 | $1,635,762 | $30,021,296 | $12,438,754 | $3,116,331 | $4,260,326 |
| | Iron ore— | | | | | | | | | |
| 77 | Tons | 340,028 | 16,760 | ..... | ..... | 3,718 | 7,060 | 1,676 | 1,812 | 363 |
| 78 | Cost | $1,326,395 | $79,255 | ..... | ..... | $15,689 | $24,465 | $8,890 | $5,600 | $1,734 |
| | Spiegeleisen, ferromanganese, and all other pig iron— | | | | | | | | | |
| 79 | Tons | 10,410,281 | 76,564 | 1,807 | 967 | 4,119 | 1,410,721 | 64,847 | 88,244 | 266,439 |
| 80 | Cost | $151,042,348 | $1,090,024 | $34,253 | $14,035 | $69,638 | $14,137,074 | $1,154,387 | $1,417,466 | $3,819,330 |
| | Old iron or steel rails, and other scrap iron and steel— | | | | | | | | | |
| 81 | Tons | 4,113,287 | 48,217 | 32,585 | 30,587 | 43,777 | 461,767 | 262,320 | 41,543 | 19,250 |
| 82 | Cost | $66,670,855 | $741,602 | $351,098 | $470,855 | $785,070 | $7,312,159 | $5,112,997 | $759,625 | $311,087 |
| | Purchased hammered iron-ore blooms, pig or scrap blooms, and imported Swedish billets and bars— | | | | | | | | | |
| 83 | Tons | 32,720 | ..... | ..... | 156 | 70 | 30 | ..... | 2,000 | ..... |
| 84 | Cost | $1,150,575 | ..... | ..... | $10,140 | $1,400 | $2,550 | ..... | $30,000 | ..... |
| | Purchased muck or scrap bar— | | | | | | | | | |
| 85 | Tons | 161,329 | ..... | ..... | 60 | 1,683 | 5,713 | ..... | ..... | 231 |
| 86 | Cost | $4,535,939 | ..... | ..... | $2,610 | $47,520 | $103,659 | ..... | ..... | $5,776 |
| | Purchased iron or steel ingots, blooms, billets, tinplate bars, sheet bars, and slabs—except imported Swedish billets and bars— | | | | | | | | | |
| 87 | Tons | 3,682,407 | 3,629 | 50 | 20,108 | 9,135 | 115,558 | 198,608 | 18,794 | 7,290 |
| 88 | Cost | $92,123,412 | $101,904 | $1,800 | $546,370 | $219,178 | $3,172,916 | $4,049,402 | $557,878 | $177,756 |
| | Purchased wire rods— | | | | | | | | | |
| 89 | Tons | 136,725 | ..... | ..... | 10,000 | 125 | 11,151 | 12,385 | ..... | ..... |
| 90 | Cost | $5,419,617 | ..... | ..... | $400,000 | $10,202 | $325,211 | $511,179 | ..... | ..... |
| | Fuel— | | | | | | | | | |
| | Anthracite coal and culm— | | | | | | | | | |
| 91 | Tons | 944,018 | ..... | ..... | 6,559 | 3,281 | 14 | 1 | ..... | 468 |
| 92 | Cost | $1,220,694 | ..... | ..... | $29,630 | $8,208 | $55 | $6 | ..... | $1,939 |
| | Bituminous coal and slack— | | | | | | | | | |
| 93 | Tons | 10,944,046 | 197,161 | 4,958 | 60,920 | 54,004 | 1,124,139 | 178,185 | 160,517 | 100,780 |
| 94 | Cost | $14,679,804 | $247,180 | $28,178 | $179,077 | $125,049 | $1,650,186 | $281,518 | $216,549 | $141,661 |
| | Coke— | | | | | | | | | |
| 95 | Tons | 827,246 | 200 | 1,600 | 239 | 625 | 74,859 | 20 | 11,473 | 13,324 |
| 96 | Cost | $2,014,390 | $600 | $4,950 | $981 | $2,482 | $270,755 | $94 | $29,177 | $40,431 |
| | Charcoal— | | | | | | | | | |
| 97 | Bushels | 2,250,022 | ..... | ..... | 4,695 | 46,400 | 43,022 | ..... | 72,897 | ..... |
| 98 | Cost | $170,345 | ..... | ..... | $380 | $3,928 | $2,390 | ..... | $5,300 | ..... |
| 99 | Natural gas | $3,098,409 | ..... | ..... | ..... | ..... | ..... | $282,852 | $3,428 | ..... |
| | Oil— | | | | | | | | | |
| 100 | Barrels | 1,302,615 | ..... | 48,140 | 1,400 | ..... | 815,024 | 18,000 | ..... | 24,931 |
| 101 | Cost | $1,158,748 | ..... | $72,237 | $1,836 | ..... | $509,770 | $23,000 | ..... | $39,331 |
| 102 | Rent of power and heat | $32,567 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 103 | Mill supplies | $10,793,679 | $74,203 | $6,946 | $24,419 | $138,585 | $928,110 | $337,886 | $21,234 | $53,075 |
| 104 | All other materials | $32,602,931 | $70,475 | $5,372 | $482,289 | $139,119 | $1,487,118 | $484,088 | $52,074 | $167,900 |
| 105 | Freight | $2,527,409 | $46,581 | $2,000 | $36,060 | $19,694 | $94,878 | $192,955 | $18,000 | $306 |
| | Products: | | | | | | | | | |
| 106 | Aggregate value | $596,689,284 | $3,904,714 | $900,854 | $4,066,836 | $3,159,641 | $45,149,498 | $19,338,481 | $5,004,572 | $5,540,179 |
| | Rolled, forged, and other classified products— | | | | | | | | | |
| 107 | Total tons | 15,040,129 | 100,318 | 25,419 | 43,908 | 53,025 | 1,485,346 | 425,946 | 129,309 | 223,306 |
| 108 | Total value | $510,388,433 | $3,899,442 | $805,104 | $2,137,110 | $2,629,979 | $37,066,574 | $17,391,548 | $4,868,043 | $4,897,152 |
| | Rails— | | | | | | | | | |
| | Iron— | | | | | | | | | |
| 109 | Tons | 880 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 110 | Value | $31,180 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | Steel— | | | | | | | | | |
| 111 | Tons | 2,250,457 | ..... | ..... | ..... | ..... | 567,398 | ..... | ..... | 185,737 |
| 112 | Value | $46,501,979 | ..... | ..... | ..... | ..... | $10,012,149 | ..... | ..... | $3,812,568 |
| | Iron and steel bars and rods, not including sheet or tin-plate bars or wire rods— | | | | | | | | | |
| 113 | Tons | 2,493,159 | 57,899 | 16,900 | 30,138 | 40,888 | 197,190 | 191,606 | 29,067 | ..... |
| 114 | Value | $100,597,221 | $2,410,938 | $547,543 | $1,222,145 | $1,848,680 | $6,374,298 | $7,754,600 | $1,339,316 | ..... |
| | Structural shapes— | | | | | | | | | |
| | Iron— | | | | | | | | | |
| 115 | Tons | 27,091 | ..... | 6,346 | ..... | ..... | ..... | ..... | ..... | ..... |
| 116 | Value | $1,051,556 | ..... | $170,641 | ..... | ..... | ..... | ..... | ..... | ..... |
| | Bessemer steel— | | | | | | | | | |
| 117 | Tons | 263,800 | ..... | ..... | ..... | ..... | 565 | ..... | ..... | ..... |
| 118 | Value | $8,381,717 | ..... | ..... | ..... | ..... | $27,000 | ..... | ..... | ..... |
| | Open-hearth steel— | | | | | | | | | |
| 119 | Tons | 566,092 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 120 | Value | $19,928,249 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | Iron and steel hoops, bands, cotton ties, and skelp— | | | | | | | | | |
| 121 | Tons | 1,195,189 | ..... | ..... | 10,000 | ..... | 61,008 | ..... | ..... | ..... |
| 122 | Value | $49,159,747 | ..... | ..... | $560,000 | ..... | $2,100,198 | ..... | ..... | ..... |
| | Iron and steel rolled car axles— | | | | | | | | | |
| 123 | Tons | 56,339 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 124 | Value | $2,757,051 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | Iron and steel hammered car axles— | | | | | | | | | |
| 125 | Tons | 46,267 | 1,822 | ..... | ..... | 518 | ..... | ..... | ..... | ..... |
| 126 | Value | $1,725,886 | $72,880 | ..... | ..... | $33,768 | ..... | ..... | ..... | ..... |
| | Iron and steel muck and scrap bar produced for sale— | | | | | | | | | |
| 127 | Tons | 203,681 | ..... | ..... | ..... | ..... | 448 | 7,536 | 37 | ..... |
| 128 | Value | $5,940,587 | ..... | ..... | ..... | ..... | $8,731 | $233,927 | $1,104 | ..... |
| | Iron and steel boiler and other plates and sheets (except nail and tack plates and armor plate)— | | | | | | | | | |
| 129 | Tons | 1,882,080 | 10,221 | ..... | ..... | 11,619 | 95,988 | 120,954 | 23,419 | 5,300 |
| 130 | Value | $89,077,029 | $562,391 | ..... | ..... | $747,531 | $3,421,785 | $6,223,460 | $1,401,709 | $263,552 |
| | Iron and steel nail plate— | | | | | | | | | |
| 131 | Tons | 81,101 | ..... | 1,039 | ..... | ..... | 3,515 | ..... | 5,607 | ..... |
| 132 | Value | $2,466,340 | ..... | $41,560 | ..... | ..... | $87,875 | ..... | $201,703 | ..... |
| | Iron and steel tack plate— | | | | | | | | | |
| 133 | Tons | 16,563 | ..... | 1,134 | ..... | ..... | ..... | ..... | ..... | ..... |
| 134 | Value | $650,218 | ..... | $45,360 | ..... | ..... | ..... | ..... | ..... | ..... |

DETAILED SUMMARY, BY STATES, 1900—Continued.

is the gross ton of 2,240 pounds.]

| Massachusetts. | Michigan. | Missouri. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $7,490,732 | $2,365,289 | $1,605,392 | $14,322,831 | $4,093,932 | $67,785,834 | $218,860,649 | $235,573 | $1,124,356 | $8,729,280 | $3,394,932 | $3,929,508 | 76 |
| 1,030 | ..... | 603 | 8,322 | 19,740 | 26,434 | 243,688 | 3,518 | 1,737 | 3,293 | 3 | 271 | 77 |
| $7,367 | ..... | $2,442 | $27,026 | $56,738 | $93,610 | $970,028 | $6,118 | $8,453 | $13,427 | $26 | $5,532 | 78 |
| 15,420 | 3,540 | 7,548 | 39,198 | 69,290 | 2,031,684 | 5,914,321 | 2,147 | 4,952 | 301,295 | 1,683 | 105,495 | 79 |
| $297,636 | $68,336 | $105,507 | $698,481 | $1,218,071 | $32,833,698 | $87,698,436 | $23,887 | $75,334 | $5,119,570 | $41,352 | $1,625,333 | 80 |
| 59,215 | 70,631 | 41,152 | 77,983 | 68,058 | 463,335 | 2,148,155 | 11,530 | 40,915 | 2,434 | 82,215 | 107,718 | 81 |
| $1,121,230 | $1,405,860 | $560,916 | $1,364,209 | $1,257,237 | $8,635,371 | $32,800,164 | $136,830 | $843,860 | $38,934 | $967,635 | $1,694,116 | 82 |
| 116 | ..... | ..... | 100 | 500 | 3,202 | 26,451 | 95 | ..... | ..... | ..... | ..... | 83 |
| $6,900 | ..... | ..... | $9,515 | $48,000 | $78,589 | $961,727 | $1,754 | ..... | ..... | ..... | ..... | 84 |
| ..... | 601 | ..... | 2,886 | 1,262 | 4,311 | 144,154 | ..... | 428 | ..... | ..... | ..... | 85 |
| ..... | $20,690 | ..... | $109,249 | $42,773 | $121,484 | $4,067,751 | ..... | $14,427 | ..... | ..... | ..... | 86 |
| 80,684 | 22,559 | 18,941 | 67,795 | 24,235 | 705,398 | 2,158,374 | 54 | 2,436 | 103,671 | 125,088 | ..... | 87 |
| $2,700,036 | $555,520 | $648,833 | $1,944,812 | $605,062 | $17,851,793 | $54,392,495 | $1,771 | $51,462 | $2,509,488 | $2,034,986 | ..... | 88 |
| 8,967 | 6 | ..... | 9,274 | ..... | 52,647 | 32,170 | ..... | ..... | ..... | ..... | ..... | 89 |
| $335,339 | $209 | ..... | $638,696 | ..... | $1,925,146 | $1,278,635 | ..... | ..... | ..... | ..... | ..... | 90 |
| 4,320 | 20 | 6 | 59,396 | 9,775 | 136,640 | 722,955 | ..... | 583 | ..... | ..... | ..... | 91 |
| $18,892 | $100 | $42 | $140,710 | $37,253 | $174,818 | $806,128 | ..... | $2,918 | ..... | ..... | ..... | 92 |
| 125,209 | 69,894 | 69,024 | 177,747 | 178,649 | 2,033,469 | 5,927,016 | 41,087 | 38,635 | 233,922 | 54,695 | 114,085 | 93 |
| $435,179 | $131,016 | $128,790 | $366,969 | $400,506 | $2,532,688 | $7,110,422 | $47,114 | $75,969 | $207,440 | $171,923 | $212,390 | 94 |
| 1,574 | 2,000 | 4,697 | 7,700 | 822 | 239,742 | 418,841 | 253 | 571 | 31,994 | 674 | 16,098 | 95 |
| $5,880 | $7,009 | $16,707 | $25,880 | $2,145 | $586,814 | $877,099 | $357 | $2,000 | $89,918 | $3,898 | $47,213 | 96 |
| 221,192 | ..... | 1,800 | 11,970 | 10,100 | 1,860 | 1,831,786 | 200 | ..... | ..... | 4,100 | ..... | 97 |
| $16,478 | ..... | $180 | $1,495 | $1,114 | $195 | $138,455 | $20 | ..... | ..... | $410 | ..... | 98 |
| ..... | ..... | ..... | ..... | ..... | $128,496 | $2,607,904 | ..... | ..... | $75,729 | ..... | ..... | 99 |
| 15,385 | 9,399 | 6,024 | 44,867 | 18,607 | 39,354 | 113,672 | 1,000 | ..... | 8,320 | 123,547 | 14,945 | 100 |
| $32,601 | $14,099 | $12,049 | $66,332 | $28,445 | $50,658 | $172,178 | $1,000 | ..... | $12,480 | $102,929 | $24,803 | 101 |
| ..... | ..... | ..... | ..... | $7,200 | $720 | $6,296 | ..... | $6,512 | ..... | ..... | $11,839 | 102 |
| $22,034 | $150,476 | $15,819 | $550,551 | $118,414 | $749,201 | $7,185,225 | $15,863 | $28,813 | $294,434 | $30,431 | $48,460 | 103 |
| $2,378,043 | $11,966 | $103,862 | $8,280,886 | $216,738 | $1,769,948 | $16,422,525 | ..... | $14,608 | $367,910 | $28,800 | $119,210 | 104 |
| $113,117 | $8 | $10,245 | $158,020 | $59,241 | $252,605 | $1,370,186 | $859 | ..... | ..... | $12,542 | $140,112 | 105 |
| $13,412,379 | $3,674,905 | $3,200,230 | $21,885,484 | $8,697,995 | $98,568,619 | $332,588,174 | $387,409 | $1,836,670 | $13,394,911 | $6,004,989 | $6,122,744 | 106 |
| 137,502 | 80,483 | 59,026 | 142,152 | 137,981 | 2,737,497 | 8,503,852 | 13,400 | 40,943 | 352,814 | 187,376 | 160,526 | 107 |
| $6,743,149 | $3,559,379 | $3,114,880 | $9,582,413 | $7,809,118 | $90,366,549 | $290,092,526 | $387,409 | $1,732,024 | $11,731,561 | $5,832,681 | $5,741,842 | 108 |
| ..... | ..... | ..... | ..... | ..... | 67 | 131 | 100 | ..... | ..... | ..... | 582 | 109 |
| ..... | ..... | ..... | ..... | ..... | $8,651 | $8,422 | $2,500 | ..... | ..... | ..... | $21,607 | 110 |
| ..... | ..... | ..... | ..... | ..... | 142,918 | 1,218,158 | 50 | ..... | ..... | 51,526 | 84,670 | 111 |
| ..... | ..... | ..... | ..... | ..... | $4,143,069 | $24,593,612 | $1,250 | ..... | ..... | $1,803,071 | $2,636,260 | 112 |
| 7,411 | 60,150 | 15,072 | 43,242 | 95,722 | 472,159 | 1,036,759 | 13,060 | 13,761 | ..... | 115,952 | 56,188 | 113 |
| $331,436 | $2,308,914 | $438,253 | $3,313,711 | $4,448,405 | $17,787,412 | $43,453,494 | $367,320 | $548,887 | ..... | $3,731,171 | $2,370,698 | 114 |
| ..... | ..... | ..... | 5,300 | ..... | ..... | 15,445 | ..... | ..... | ..... | ..... | ..... | 115 |
| ..... | ..... | ..... | $263,000 | ..... | ..... | $617,915 | ..... | ..... | ..... | ..... | ..... | 116 |
| ..... | ..... | ..... | ..... | 2,545 | 34,195 | 225,458 | ..... | ..... | ..... | ..... | 1,037 | 117 |
| ..... | ..... | ..... | ..... | $120,264 | $1,143,872 | $7,032,494 | ..... | ..... | ..... | ..... | $58,087 | 118 |
| ..... | ..... | ..... | 40,000 | ..... | ..... | 526,092 | ..... | ..... | ..... | ..... | ..... | 119 |
| ..... | ..... | ..... | $2,000,000 | ..... | ..... | $17,928,249 | ..... | ..... | ..... | ..... | ..... | 120 |
| ..... | ..... | ..... | ..... | 9,100 | 128,188 | 828,050 | ..... | ..... | 158,843 | ..... | ..... | 121 |
| ..... | ..... | ..... | ..... | $366,015 | $4,452,276 | $35,898,558 | ..... | ..... | $6,282,700 | ..... | ..... | 122 |
| ..... | ..... | ..... | 1,592 | ..... | ..... | 54,747 | ..... | ..... | ..... | ..... | ..... | 123 |
| ..... | ..... | ..... | $93,861 | ..... | ..... | $2,658,190 | ..... | ..... | ..... | ..... | ..... | 124 |
| ..... | 7,318 | 8,018 | ..... | ..... | ..... | 26,636 | ..... | 1,960 | ..... | ..... | ..... | 125 |
| ..... | $284,249 | $344,891 | ..... | ..... | ..... | $911,698 | ..... | $78,400 | ..... | ..... | ..... | 126 |
| ..... | ..... | ..... | 2,368 | ..... | 21,261 | 167,165 | ..... | 342 | 4,344 | ..... | 180 | 127 |
| ..... | ..... | ..... | $75,010 | ..... | $594,268 | $4,901,446 | ..... | $7,798 | $113,443 | ..... | $4,860 | 128 |
| ..... | ..... | 17,203 | 1,539 | ..... | 308,092 | 1,245,843 | ..... | ..... | 39,215 | ..... | 2,687 | 129 |
| ..... | ..... | $1,118,195 | $87,060 | ..... | $16,110,691 | $56,984,914 | ..... | ..... | $2,005,291 | ..... | $150,450 | 130 |
| 7,353 | ..... | ..... | ..... | ..... | 16,094 | 40,805 | ..... | 592 | 6,096 | ..... | ..... | 131 |
| $216,100 | ..... | ..... | ..... | ..... | $680,644 | $1,020,665 | ..... | $20,069 | $197,724 | ..... | ..... | 132 |
| 9,017 | ..... | ..... | ..... | ..... | ..... | 1,412 | ..... | ..... | 5,000 | ..... | ..... | 133 |
| $338,070 | ..... | ..... | ..... | ..... | ..... | $66,438 | ..... | ..... | $200,350 | ..... | ..... | 134 |

[1] Includes establishments distributed as follows: Colorado, 2; Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.

TABLE 72, PART I.—ROLLING MILLS AND STEEL WORKS:

[The ton when used as a unit of measure

| | | United States. | Alabama. | California. | Connecticut. | Delaware. | Illinois. | Indiana. | Kentucky. | Maryland. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Products—Continued. | | | | | | | | | |
| | Aggregate value—Continued. | | | | | | | | | |
| | Rolled, forged, and other classified products—Continued. | | | | | | | | | |
| | Total value—Continued. | | | | | | | | | |
| | Iron and steel armor plate and gun forgings— | | | | | | | | | |
| 135 | Tons | 15,302 | | | | | | | | |
| 136 | Value | $7,526,479 | | | | | | | | |
| | Iron and steel rolled blooms, slabs, billets, tin-plate bars, and sheet bars produced for sale— | | | | | | | | | |
| 137 | Tons | 4,172,286 | 30,376 | | | | 260,042 | 78,680 | 46,584 | 29,479 |
| 138 | Value | $96,321,887 | $858,283 | | | | $4,805,431 | $1,794,292 | $1,133,389 | $623,148 |
| | All other rolled iron and steel products, including wire rods— | | | | | | | | | |
| 139 | Tons | 1,423,467 | | | 1,500 | | 242,403 | 20,580 | 24,595 | 2,454 |
| 140 | Value | $54,732,135 | | | $75,000 | | $6,948,082 | $862,849 | $790,822 | $156,790 |
| | All other forged iron and steel products— | | | | | | | | | |
| 141 | Tons | 65,512 | | | 1,208 | | 9,547 | | | 336 |
| 142 | Value | $6,148,134 | | | $147,523 | | $449,978 | | | $41,094 |
| | Ingots produced for sale— | | | | | | | | | |
| 143 | Tons | 103,707 | | | | | 8,219 | 400 | | |
| 144 | Value | $2,781,145 | | | | | $110,280 | $4,000 | | |
| | Direct steel castings— | | | | | | | | | |
| 145 | Tons | 177,156 | | | 1,062 | | 39,023 | 6,190 | | |
| 146 | Value | $14,609,893 | | | $132,442 | | $2,660,767 | $518,420 | | |
| 147 | All other products, not classified, including amount received for custom work and repairing. | $86,300,851 | $5,272 | $95,750 | $1,929,726 | $529,662 | $8,082,924 | $1,946,933 | $136,529 | $643,027 |
| | Miscellaneous products, not rolled, value previously included— | | | | | | | | | |
| | Cut nails— | | | | | | | | | |
| 148 | Total value | $3,292,063 | | $45,750 | | | $136,199 | | $331,431 | |
| | Iron, or combined iron, and steel— | | | | | | | | | |
| 149 | Kegs of 100 pounds | 738,100 | | 18,300 | | | 71,137 | | | |
| 150 | Value | $1,364,255 | | $45,750 | | | $136,199 | | | |
| | Steel— | | | | | | | | | |
| 151 | Kegs of 100 pounds | 920,343 | | | | | | | 125,281 | |
| 152 | Value | $1,927,808 | | | | | | | $331,431 | |
| | Iron and steel wire nails— | | | | | | | | | |
| 153 | Kegs of 100 pounds | 4,603,010 | | | 36,500 | | 269,643 | 359,660 | | |
| 154 | Value | $12,445,096 | | | $109,500 | | $719,047 | $1,071,787 | | |
| | Iron and steel wire— | | | | | | | | | |
| 155 | Tons | 579,595 | | | 9,600 | | 27,467 | 24,623 | | |
| 156 | Value | $35,283,688 | | | $720,000 | | $1,508,822 | $1,401,380 | | |
| | Machinery: | | | | | | | | | |
| | Rolling mills and steel works— | | | | | | | | | |
| | Rolling mills— | | | | | | | | | |
| 157 | Total daily capacity, double turn, of rolled iron or steel, tons. | 86,964 | 1,770 | 138 | 289 | 318 | 9,296 | 2,377 | 1,075 | 1,380 |
| | Bessemer steel or modified Bessemer steel plants— | | | | | | | | | |
| 158 | Converters, number | 70 | | 1 | 1 | | 8 | | 2 | 2 |
| 159 | Total daily capacity of ingots, double turn, tons. | 34,925 | | 7 | 8 | | 5,050 | | 500 | 2,000 |
| | Open-hearth steel plants— | | | | | | | | | |
| 160 | Acid and basic furnaces, number | 307 | 12 | | 1 | | 24 | 8 | | 1 |
| 161 | Daily capacity of acid and basic ingots, double turn, tons. | 18,245 | 1,120 | | 10 | | 1,498 | 333 | | 80 |
| 162 | Acid furnaces, number | 189 | | | 1 | | 4 | 5 | | 1 |
| 163 | Total daily capacity of acid ingots, double turn, tons. | 6,094 | | | 10 | | 223 | 208 | | 80 |
| 164 | Basic furnaces, number | 168 | 12 | | | | 20 | 3 | | |
| 165 | Total daily capacity of basic ingots, double turn, tons. | 12,151 | 1,120 | | | | 1,275 | 130 | | |
| | Crucible, blister, German, and miscellaneous steel plants— | | | | | | | | | |
| 166 | Crucible furnaces, number | 159 | | | 2 | | 1 | 2 | | 1 |
| 167 | Crucible steel pot holes, number | 2,528 | | | 40 | | 12 | 16 | | 24 |
| 168 | Total daily capacity of crucible and other ingots, double turn, tons. | 575 | | | 10 | | 3 | 4 | | 4 |
| | Comparison of products: | | | | | | | | | |
| 169 | Number of establishments reporting for both years. | 236 | 2 | 1 | 4 | 6 | 11 | 4 | 5 | 2 |
| 170 | Value for census year | $404,703,901 | $1,740,148 | $817,907 | $2,191,132 | $3,159,641 | $34,468,377 | $2,284,977 | $4,319,693 | $5,192,088 |
| 171 | Value for preceding business year | $260,667,764 | $1,085,732 | $278,007 | $1,708,491 | $1,487,902 | $26,520,798 | $1,819,713 | $1,822,073 | $3,067,457 |
| | Power: | | | | | | | | | |
| 172 | Number of establishments reporting | 438 | 6 | 3 | 7 | 6 | 22 | 27 | 6 | 5 |
| 173 | Total horsepower | 1,164,035 | 19,224 | 2,056 | 8,492 | 4,925 | 88,470 | 40,650 | 17,250 | 14,597 |
| | Owned— | | | | | | | | | |
| | Engines— | | | | | | | | | |
| | Steam— | | | | | | | | | |
| 174 | Number | 5,428 | 105 | 15 | 48 | 68 | 244 | 225 | 73 | 56 |
| 175 | Horsepower | 1,086,450 | 18,606 | 2,056 | 6,988 | 4,835 | 75,566 | 39,690 | 17,250 | 13,843 |
| | Gas or gasoline— | | | | | | | | | |
| 176 | Number | 16 | | | 1 | | | 2 | | |
| 177 | Horsepower | 1,543 | | | 6 | | | 260 | | |
| | Water wheels— | | | | | | | | | |
| 178 | Number | 103 | | | 12 | 1 | 22 | | | 2 |
| 179 | Horsepower | 7,967 | | | 1,546 | 90 | 225 | | | 200 |
| | Electric motors— | | | | | | | | | |
| 180 | Number | 3,220 | 4 | | 1 | | 316 | 44 | | 29 |
| 181 | Horsepower | 65,781 | 618 | | 2 | | 5,854 | 700 | | 554 |
| 182 | Other power, horsepower | 3,160 | | | | | 1,825 | | | |
| | Rented— | | | | | | | | | |
| 183 | Electric, horsepower | 877 | | | | | | | | |
| 184 | Other kind, horsepower | 257 | | | | | | | | |
| 185 | Furnished to other establishments, horsepower. | 2,504 | 30 | | 5 | | | | 250 | 50 |

DETAILED SUMMARY, BY STATES, 1900—Continued.

is the gross ton of 2,240 pounds.]

| Massachusetts. | Michigan. | Missouri. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | 15,302 | | | | | | 135 |
| | | | | | | $7,526,479 | | | | | | 136 |
| | | | | | | | | | | | | |
| 187 | 190 | | | | 1,320,750 | 2,268,858 | | | 135,631 | | 1,509 | 137 |
| $6,199 | $5,890 | | | | $32,486,609 | $51,671,460 | | | $2,835,517 | | $46,719 | 138 |
| 106,279 | 10,000 | 8,378 | 37,879 | 13,196 | 271,011 | 633,156 | 67 | 24,288 | | 17,601 | 10,080 | 139 |
| $5,313,950 | $750,000 | $427,216 | $2,492,052 | $1,217,814 | $11,281,444 | $22,442,526 | $7,795 | $1,076,870 | | $501,891 | $387,534 | 140 |
| 547 | | 755 | | 3,133 | 4,360 | 45,626 | | | | | | 141 |
| $67,280 | | $66,275 | | $499,138 | $253,875 | $4,622,971 | | | | | | 142 |
| | 580 | | | 3,000 | | 84,498 | | | 3,685 | | 3,375 | 143 |
| | $14,826 | | | $45,000 | | $2,459,693 | | | $96,536 | | $50,810 | 144 |
| 6,708 | 2,300 | 9,600 | 10,232 | 11,285 | 18,402 | 69,711 | 123 | | | 2,297 | 223 | 145 |
| $470,114 | $195,500 | $720,000 | $1,252,719 | $1,112,982 | $1,428,738 | $5,798,302 | $8,544 | | | $296,548 | $14,817 | 146 |
| $6,669,230 | $15,526 | $85,400 | $12,253,071 | $888,877 | $8,202,070 | $42,495,648 | | $104,646 | $1,668,350 | $172,308 | $380,902 | 147 |
| | | | | | | | | | | | | |
| $274,676 | | | | | $709,717 | $1,519,393 | | $27,354 | $247,543 | | | 148 |
| 70,972 | | | | | 62,586 | 493,585 | | 11,006 | 10,514 | | | 149 |
| $161,357 | | | | | $129,390 | $840,375 | | $27,354 | $23,880 | | | 150 |
| 63,449 | | | | | 267,479 | 350,155 | | | 113,979 | | | 151 |
| $113,319 | | | | | $580,327 | $679,018 | | | $228,713 | | | 152 |
| 81,394 | | | | | 1,631,793 | 2,224,020 | | | | | | 153 |
| $252,321 | | | | | $4,418,770 | $5,873,671 | | | | | | 154 |
| 77,731 | | | 27,873 | | 181,462 | 230,839 | | | | | | 155 |
| $5,829,825 | | | $2,457,429 | | $10,386,098 | $12,980,134 | | | | | | 156 |
| 1,590 | 440 | 265 | 828 | 1,298 | 12,374 | 48,364 | 100 | 473 | 2,011 | 645 | 1,938 | 157 |
| | 2 | | | | 12 | 33 | | | 4 | 2 | 3 | 158 |
| | 10 | | | | 7,573 | 17,977 | | | 1,160 | 80 | 610 | 159 |
| 10 | 1 | 3 | 7 | 8 | 27 | 199 | 1 | | | 2 | 3 | 160 |
| 576 | 30 | 42 | 310 | 190 | 1,218 | 12,745 | 6 | | | 37 | 100 | 161 |
| 8 | 1 | | 5 | 5 | 13 | 93 | 1 | | | 2 | | 162 |
| 440 | 30 | | 210 | 86 | 478 | 4,341 | 6 | | | 87 | | 163 |
| 2 | | 3 | 2 | 3 | 14 | 106 | | | | | 3 | 164 |
| 136 | | 42 | 100 | 104 | 740 | 8,404 | | | | | 100 | 165 |
| | | | 54 | 14 | 6 | 65 | 1 | | | 13 | | 166 |
| | | | 300 | 218 | 12 | 1,856 | 8 | | | 42 | | 167 |
| | | | 89 | 46 | 1 | 409 | 3 | | | 6 | | 168 |
| 5 | 2 | 4 | 13 | 14 | 23 | 116 | 3 | 2 | 7 | 4 | 8 | 169 |
| $1,278,751 | $2,904,056 | $2,082,035 | $20,796,551 | $6,993,405 | $30,834,658 | $259,831,701 | $337,409 | $1,356,494 | $12,633,697 | $5,848,957 | $6,082,224 | 170 |
| $972,134 | $1,634,660 | $1,381,107 | $13,104,245 | $4,492,241 | $20,188,837 | $165,256,064 | $264,844 | $812,920 | $7,397,034 | $3,278,894 | $4,104,611 | 171 |
| 7 | 3 | 5 | 16 | 20 | 64 | 209 | 3 | 4 | 8 | 7 | 10 | 172 |
| 30,035 | 8,200 | 3,330 | 30,177 | 14,417 | 219,737 | 618,888 | 2,875 | 4,100 | 23,476 | 6,835 | 11,301 | 173 |
| 112 | 33 | 20 | 138 | 106 | 815 | 3,091 | 19 | 26 | 99 | 25 | 110 | 174 |
| 28,060 | 7,600 | 3,330 | 28,939 | 12,759 | 211,329 | 570,543 | 2,875 | 2,000 | 23,416 | 6,230 | 10,585 | 175 |
| | | | | | | 18 | | | | | | 176 |
| | | | | | | 1,277 | | | | | | 177 |
| 14 | | | 6 | 8 | 2 | 17 | | 19 | | | | 179 |
| 905 | | | 640 | 1,150 | 185 | 926 | | 2,100 | | | | 178 |
| 36 | 2 | | 45 | 4 | 379 | 2,269 | | | 2 | 49 | 40 | 180 |
| 1,070 | 600 | | 598 | 333 | 8,116 | 44,155 | | | 60 | 605 | 516 | 181 |
| | | | | | | 1,335 | | | | | | 182 |
| | | | | 25 | 107 | 545 | | | | | 200 | 183 |
| | | | | 150 | | 107 | | | | | | 184 |
| | | | 140 | | 1,969 | 30 | | | | 30 | | 185 |

[1] Includes establishments distributed as follows: Colorado, 2, Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.

TABLE 72, PART I.—ROLLING MILLS AND STEEL WORKS:

[The ton when used as a unit of measure

| | | United States. | Alabama. | California. | Connecticut. | Delaware. | Illinois. | Indiana. | Kentucky. | Maryland. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | | | | | |
| 186 | Total number of establishments | 438 | 6 | 3 | 7 | 6 | 22 | 27 | 6 | 5 |
| 187 | Under 5 | 1 | ..... | ..... | ..... | ..... | ..... | 1 | ..... | ..... |
| 188 | 5 to 20 | 10 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 189 | 21 to 50 | 12 | ..... | ..... | ..... | ..... | 1 | 1 | ..... | 1 |
| 190 | 51 to 100 | 48 | ..... | 1 | 1 | 2 | 1 | 1 | ..... | ..... |
| 191 | 101 to 250 | 112 | 1 | 1 | 2 | 3 | 5 | 8 | 2 | ..... |
| 192 | 251 to 500 | 132 | 3 | ..... | 3 | ..... | 6 | 10 | 3 | 3 |
| 193 | 501 to 1,000 | 81 | 1 | 1 | 1 | ..... | 3 | 4 | 1 | 1 |
| 194 | Over 1,000 | 47 | 1 | ..... | ..... | 1 | 6 | 2 | ..... | ..... |

DETAILED SUMMARY, BY STATES, 1900—Continued.

is the gross ton of 2,240 pounds.]

| Massachusetts. | Michigan. | Missouri. | New Jersey. | New York. | Ohio. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | All other states.[1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 | 5 | 16 | 20 | 64 | 209 | 3 | 4 | 8 | 7 | 10 | 186 |
| | | | | | | | | | | | | 187 |
| | | | | | 2 | 5 | 1 | | | 1 | 1 | 188 |
| 1 | | | | 3 | | 3 | | | | 1 | 1 | 189 |
| | | 1 | 2 | 4 | 4 | 22 | 1 | | | 1 | 2 | 190 |
| 3 | | | 5 | 5 | 12 | 57 | 1 | 1 | 1 | 3 | 2 | 191 |
| 2 | 1 | 3 | 2 | 5 | 25 | 57 | | 1 | 5 | | 3 | 192 |
| | 2 | 1 | 5 | 2 | 13 | 43 | | 2 | 1 | | | 193 |
| 1 | | | 2 | 1 | 3 | 22 | | | 1 | 1 | 1 | 194 |

[1] Includes establishments distributed as follows: Colorado, 2; Kansas, 1; Maine, 1; Minnesota, 2; Oregon, 1; Rhode Island, 1; Washington, 1; Wyoming, 1.

TABLE 72, PART II.—CAPITAL, EQUIPMENT, DAILY CAPACITY AND POWER OF

[The ton when used as a unit of measure

| | | United States. | Alabama. | California. | Illinois. | Indiana. | Kentucky. |
|---|---|---|---|---|---|---|---|
| 1 | Number of establishments | 38 | 3 | 1 | 1 | 2 | 1 |
| | Character of organization: | | | | | | |
| 2 | Individual | 6 | ..... | ..... | ..... | 1 | ..... |
| 3 | Firm and limited partnership | 4 | ..... | ..... | ..... | ..... | ..... |
| 4 | Incorporated company | 28 | 3 | 1 | 1 | 1 | 1 |
| | Capital: | | | | | | |
| 5 | Total | $8,077,612 | $225,731 | $15,000 | $14,000 | $600,000 | $40,000 |
| 6 | Land | $1,045,463 | $67,000 | $10,000 | $2,000 | $60,000 | $10,000 |
| 7 | Buildings | $1,864,494 | $25,500 | $1,000 | $2,000 | $100,000 | $5,000 |
| 8 | Machinery, tools, and implements | $3,890,013 | $131,576 | $4,000 | $10,000 | $440,000 | $25,000 |
| 9 | Cash and sundries | $1,277,642 | $1,655 | ..... | ..... | ..... | ..... |
| | Rented property: | | | | | | |
| 10 | Total | $52,875 | ..... | ..... | ..... | ..... | ..... |
| 11 | Land | $31,875 | ..... | ..... | ..... | ..... | ..... |
| 12 | Buildings | $8,500 | ..... | ..... | ..... | ..... | ..... |
| 13 | Machinery, tools, and implements | $12,500 | ..... | ..... | ..... | ..... | ..... |
| | Machinery: | | | | | | |
| | Rolling mills and steel works— | | | | | | |
| | Rolling mills— | | | | | | |
| 14 | Completed, number | 31 | 2 | 1 | 1 | 2 | 1 |
| 15 | Total daily capacity, double turn of rolled iron and steel, tons. | 3,158 | 100 | 25 | 70 | 210 | 30 |
| | Bessemer steel, or modified Bessemer steel plants— | | | | | | |
| 16 | Converters, number | [1]21 | ..... | ..... | ..... | 4 | ..... |
| 17 | Total daily capacity of ingots, double turn, tons | [1]3,495 | ..... | ..... | ..... | 330 | ..... |
| | Open-hearth steel plants— | | | | | | |
| 18 | Acid and basic furnaces, number | [2]24 | ..... | 1 | 2 | ..... | 5 |
| 19 | Daily capacity of acid and basic ingots, double turn, tons | [2]785 | ..... | 30 | 80 | ..... | 214 |
| 20 | Acid furnaces, number | [2]13 | ..... | ..... | 2 | ..... | 1 |
| 21 | Total daily capacity of acid ingots, double turn, tons. | [2]325 | ..... | ..... | 80 | ..... | 14 |
| 22 | Basic furnaces, number | 11 | 1 | ..... | ..... | ..... | 4 |
| 23 | Total daily capacity of basic ingots, double turn, ton | 460 | 30 | ..... | ..... | ..... | 200 |
| | Crucible, blister, German, and miscellaneous steel plants— | | | | | | |
| 24 | Crucible steel pot holes, number | 91 | ..... | ..... | ..... | ..... | ..... |
| 25 | Total daily capacity of crucible and other ingots, double turn, tons. | 6 | ..... | ..... | ..... | ..... | ..... |
| | Power: | | | | | | |
| 26 | Number of establishments reporting | 30 | 3 | 1 | 1 | 1 | 1 |
| 27 | Total horsepower | 31,770 | 600 | 350 | 1,000 | 1,500 | 1,000 |
| | Owned— | | | | | | |
| | Engines— | | | | | | |
| | Steam— | | | | | | |
| 28 | Number | 131 | 4 | 4 | 2 | 4 | 8 |
| 29 | Horsepower | 31,350 | 600 | 350 | 1,000 | 1,500 | 1,000 |
| | Water wheels— | | | | | | |
| 30 | Number | 4 | ..... | ..... | ..... | ..... | ..... |
| 31 | Horsepower | 300 | ..... | ..... | ..... | ..... | ..... |
| | Electric motors— | | | | | | |
| 32 | Number | 6 | ..... | ..... | ..... | ..... | ..... |
| 33 | Horsepower | 120 | ..... | ..... | ..... | ..... | ..... |

[1] Includes 1 converter, with a daily capacity of 100 tons, reported by an active establishment in Massachusetts.

IDLE ROLLING MILLS AND STEEL WORKS: BY STATES, 1900.

is the gross ton of 2,240 pounds.]

| Maine. | Maryland. | Minnesota. | New Jersey. | New York. | Pennsylvania. | Tennessee. | Virginia. | West Virginia. | Wisconsin. | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 3 | 15 | 1 | 2 | 1 | 1 | 1 |
| ..... | ..... | 1 | ..... | ..... | 3 | 1 | ..... | ..... | ..... | 2 |
| ..... | ..... | ..... | ..... | ..... | 4 | ..... | ..... | ..... | ..... | 3 |
| 1 | 1 | 1 | 3 | 3 | 8 | ..... | 2 | 1 | 1 | 4 |
| $75,000 | $67,500 | $1,449,776 | $169,943 | $1,158,532 | $2,607,082 | $650 | $203,538 | $130,535 | $1,320,325 | 5 |
| $30,749 | $5,000 | $263,500 | $53,000 | $107,500 | $305,126 | $50 | $80,538 | $13,500 | $37,500 | 6 |
| $16,844 | $15,000 | $98,594 | $55,047 | $330,000 | $838,842 | $200 | $51,000 | $31,878 | $293,589 | 7 |
| $9,411 | $47,500 | $188,230 | $48,299 | $700,000 | $1,183,960 | $400 | $72,000 | $40,401 | $989,236 | 8 |
| $17,996 | ..... | $899,452 | $13,597 | $21,032 | $279,154 | ..... | ..... | $44,756 | ..... | 9 |
| ..... | ..... | ..... | ..... | ..... | $52,875 | ..... | ..... | ..... | ..... | 10 |
| ..... | ..... | ..... | ..... | ..... | $31,875 | ..... | ..... | ..... | ..... | 11 |
| ..... | ..... | ..... | ..... | ..... | $8,500 | ..... | ..... | ..... | ..... | 12 |
| ..... | ..... | ..... | ..... | ..... | $12,500 | ..... | ..... | ..... | ..... | 13 |
| 1 | 1 | 2 | 1 | 2 | 12 | 1 | 2 | 1 | 1 | 14 |
| 80 | 6 | 450 | 20 | 900 | 904 | 20 | 135 | 78 | 130 | 15 |
| ..... | ..... | ..... | ..... | 3 | 9 | ..... | 2 | ..... | 2 | 16 |
| ..... | ..... | ..... | ..... | 665 | 1,400 | ..... | 200 | ..... | 800 | 17 |
| ..... | ..... | 1 | 2 | 4 | 6 | ..... | ..... | ..... | 1 | 18 |
| ..... | ..... | 40 | 25 | 160 | 180 | ..... | ..... | ..... | 2 | 19 |
| ..... | ..... | 1 | 1 | 2 | 3 | ..... | ..... | ..... | 1 | 20 |
| ..... | ..... | 40 | 15 | 40 | 80 | ..... | ..... | ..... | 2 | 21 |
| ..... | ..... | ..... | 1 | 2 | 3 | ..... | ..... | ..... | ..... | 22 |
| ..... | ..... | ..... | 10 | 120 | 100 | ..... | ..... | ..... | ..... | 23 |
| ..... | ..... | ..... | ..... | ..... | 88 | ..... | ..... | ..... | 3 | 24 |
| ..... | ..... | ..... | ..... | ..... | 5 | ..... | ..... | ..... | 1 | 25 |
| 1 | 1 | 2 | 2 | 2 | 11 | 1 | 2 | 1 | ..... | 26 |
| 700 | 225 | 4,700 | 100 | 11,750 | 6,585 | 100 | 1,360 | 1,800 | ..... | 27 |
| 5 | 1 | 9 | 2 | 35 | 44 | 1 | 9 | 3 | ..... | 28 |
| 700 | 25 | 4,700 | 100 | 11,750 | 6,465 | 100 | 1,360 | 1,700 | ..... | 29 |
| ..... | 2 | ..... | ..... | ..... | 2 | ..... | ..... | ..... | ..... | 30 |
| ..... | 200 | ..... | ..... | ..... | 100 | ..... | ..... | ..... | ..... | 31 |
| ..... | ..... | ..... | ..... | ..... | 2 | ..... | ..... | 4 | ..... | 32 |
| ..... | ..... | ..... | ..... | ..... | 20 | ..... | ..... | 100 | ..... | 33 |

[1] Includes 2 acid furnaces, with a daily capacity of 54 tons, reported by an active establishment in Ohio.

TABLE 72, PART III.—CAPITAL, EQUIPMENT, DAILY CAPACITY, AND POWER OF BUILDING ROLLING MILLS AND STEEL WORKS: BY STATES, 1900.

[The ton when used as a unit of measure is the gross ton of 2,240 pounds.]

| | United States. | Alabama. | Georgia. | Illinois. | Indiana. | Kentucky. | Massachusetts. | Missouri. | New York. | Ohio. | Pennsylvania. | West Virginia. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of establishments | 29 | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 1 | 6 | 9 | 1 |
| Character of organization: | | | | | | | | | | | | |
| Individual | 3 | ..... | ..... | 1 | ..... | ..... | ..... | ..... | ..... | 2 | ..... | ..... |
| Firm and limited partnership | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Incorporated company | 25 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 3 | 9 | 1 |
| Miscellaneous | 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1 | ..... | ..... |
| Capital: | | | | | | | | | | | | |
| Total | $5,212,262 | $765,900 | $48,000 | $384,060 | $775,000 | $35,000 | $510,000 | $180,008 | $260,000 | $1,562,700 | $441,599 | $250,000 |
| Land | $751,773 | $27,000 | ..... | $27,300 | $61,000 | $5,000 | $325,000 | $17,100 | $25,000 | $146,200 | $111,173 | $7,000 |
| Buildings | $1,161,875 | $98,565 | $8,000 | $113,700 | $240,000 | $10,000 | $60,000 | $74,299 | $50,000 | $339,000 | $128,311 | $40,000 |
| Machinery, tools, and implements | $2,881,928 | $616,259 | $40,000 | $237,460 | $310,000 | $20,000 | $100,000 | $61,150 | $150,000 | $988,000 | $159,059 | $200,000 |
| Cash and sundries | $416,686 | $24,076 | ..... | $5,600 | $164,000 | ..... | $25,000 | $27,454 | $35,000 | $89,500 | $43,056 | $3,000 |
| Rented property: | | | | | | | | | | | | |
| Total | $28,020 | ..... | $5,000 | ..... | ..... | ..... | ..... | $1,500 | ..... | ..... | $21,520 | ..... |
| Land | $25,020 | ..... | $5,000 | ..... | ..... | ..... | ..... | $1,500 | ..... | ..... | $18,520 | ..... |
| Buildings | $3,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | $3,000 | ..... |
| Machinery: | | | | | | | | | | | | |
| Rolling mills and steel works— | | | | | | | | | | | | |
| Rolling mills— | | | | | | | | | | | | |
| Number | 18 | 1 | 1 | 2 | 1 | 1 | ..... | 1 | 1 | 4 | 5 | 1 |
| Total daily capacity, double turn, of rolled iron and steel, tons | 2,638 | 330 | 50 | 225 | 200 | 50 | ..... | 45 | 170 | 1,270 | 228 | 70 |
| Bessemer steel or modified Bessemer steel plants— | | | | | | | | | | | | |
| Converters, number | 2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2 | ..... | ..... |
| Total daily capacity of ingots, double turn, tons | 1,170 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1,170 | ..... | ..... |
| Open-hearth steel works— | | | | | | | | | | | | |
| Acid and basic furnaces, number | [1]48 | 1 | ..... | 4 | 2 | 3 | 2 | 3 | ..... | 3 | 20 | ..... |
| Total daily capacity of acid and basic ingots, double turn, tons | [1]2,920 | 40 | ..... | 120 | 120 | 150 | 60 | 120 | ..... | 130 | 1,680 | ..... |
| Acid furnaces, number | [1]11 | ..... | ..... | ..... | ..... | ..... | 2 | 1 | ..... | 2 | 5 | ..... |
| Total daily capacity of acid ingots, double turn, tons | [1]460 | ..... | ..... | ..... | ..... | ..... | 60 | 40 | ..... | 80 | 180 | ..... |
| Basic furnaces, number | [1]32 | 1 | ..... | 4 | 2 | 3 | ..... | 2 | ..... | 1 | 15 | ..... |
| Total daily capacity of basic ingots, double turn, tons | [1]2,460 | 40 | ..... | 120 | 120 | 150 | ..... | 80 | ..... | 50 | 1,500 | ..... |
| Crucible, steel plants— | | | | | | | | | | | | |
| Crucible steel pot holes, number | 28 | ..... | ..... | ..... | ..... | ..... | 20 | ..... | ..... | 8 | ..... | ..... |
| Total daily capacity of crucible ingots, double turn, tons | 2 | ..... | ..... | ..... | ..... | ..... | 1½ | ..... | ..... | ½ | ..... | ..... |
| Power: | | | | | | | | | | | | |
| Number of establishments reporting | 16 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | ..... | 2 | 5 | 1 |
| Total horsepower | 18,225 | 10,115 | 750 | 1,005 | 1,425 | 300 | 540 | 1,250 | ..... | 865 | 1,975 | ..... |
| Owned— | | | | | | | | | | | | |
| Engines— | | | | | | | | | | | | |
| Steam— | | | | | | | | | | | | |
| Number | 64 | 16 | 4 | 5 | 11 | 2 | 2 | 8 | ..... | 4 | 12 | ..... |
| Horsepower | 17,705 | 10,115 | 750 | 725 | 1,425 | 300 | 300 | 1,250 | ..... | 865 | 1,975 | ..... |
| Gas or gasoline— | | | | | | | | | | | | |
| Number | 1 | ..... | ..... | 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Horsepower | 6 | ..... | ..... | 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Electric motors— | | | | | | | | | | | | |
| Number | 8 | ..... | ..... | 1 | ..... | ..... | 7 | ..... | ..... | ..... | ..... | ..... |
| Horsepower | 490 | ..... | ..... | 250 | ..... | ..... | 240 | ..... | ..... | ..... | ..... | ..... |
| Other power, horsepower | 24 | ..... | ..... | 24 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

[1] Includes 1 acid furnace, with a capacity of 100 tons, and 4 basic furnaces, with a capacity of 400 tons, reported by an active establishment in Delaware.

TABLE 73.—FORGES AND BLOOMERIES: DETAILED SUMMARY, 1900.

[The ton when used as a unit of measure is the gross ton of 2,240 pounds.]

| | United States. | | United States. |
|---|---|---|---|
| Number of establishments[1] | 7 | Salaried officials, clerks, etc.: | |
| Character of organization: | | Total number | 12 |
| Individual | 1 | Total salaries | $11,500 |
| Firm and limited partnership | 3 | Officers of corporations— | |
| Incorporated company | 3 | Number | 3 |
| Capital: | | Salaries | $3,500 |
| Total | $272,388 | General superintendents, managers, clerks, etc.— | |
| Land | $11,100 | Total number | 9 |
| Buildings | $27,100 | Total salaries | $8,000 |
| Machinery, tools, and implements | $37,320 | Men— | |
| Cash and sundries | $196,868 | Number | 9 |
| Rented property: | | Salaries | $8,000 |
| Total | $236,000 | Wage-earners, including pieceworkers, and total wages: | |
| Land | $116,000 | Greatest number employed at any one time during the year | 242 |
| Buildings | $95,000 | Least number employed at any one time during the year | 219 |
| Machinery | $25,000 | Average number | 226 |
| Proprietors and firm members | 3 | Wages | $97,184 |

[1] Includes active establishments only, distributed as follows: Maryland, 1; New York, 1; Pennsylvania, 5.

TABLE 73.—FORGES AND BLOOMERIES: DETAILED SUMMARY, 1900—Continued.

[The ton when used as a unit of measure is the gross ton of 2,240 pounds.]

| | United States. |
|---|---|
| Wage-earners, including pieceworkers, and total wages—Continued. | |
| Wages—Continued. | |
| Men, 16 years and over— | |
| Average number | 226 |
| Wages | $97,184 |
| Average number of wage-earners, including pieceworkers, employed during each month: | |
| Men, 16 years and over— | |
| January | 231 |
| February | 232 |
| March | 221 |
| April | 232 |
| May | 232 |
| June | 216 |
| July | 204 |
| August | 214 |
| September | 231 |
| October | 232 |
| November | 232 |
| December | 232 |
| Miscellaneous expenses: | |
| Total | $15,203 |
| Rent of works | $4,680 |
| Taxes, not including internal revenue | $798 |
| Rent of offices, interest, insurance, and all sundry expenses not hitherto included | $9,725 |
| Materials used: | |
| Total cost | $327,160 |
| Iron ore— | |
| Tons | 6,282 |
| Cost | $22,414 |
| Pig iron— | |
| Tons | 1,000 |
| Cost | $22,000 |
| Old or scrap iron and steel— | |
| Tons | 13,693 |
| Cost | $181,766 |
| Fuel— | |
| Bituminous coal and slack— | |
| Tons | 1,553 |
| Cost | $2,771 |
| Coke— | |
| Tons | 60 |
| Cost | $240 |
| Charcoal— | |
| Bushels | 1,538,280 |
| Cost | $85,241 |
| Mill supplies | $3,397 |
| Freight | $9,331 |
| Products: | |
| Total value | $522,432 |
| Blooms, billets, slabs, or hammered bar iron made from— | |
| Ore— | |
| Tons | 3,142 |
| Value | $114,413 |

| | United States. |
|---|---|
| Products—Continued. | |
| Total value—Continued. | |
| Blooms, billets, slabs, or hammered bar iron made from—Con. | |
| Pig iron and scrap iron and steel— | |
| Tons | 12,355 |
| Value | $403,194 |
| Value of all other products | $4,825 |
| Completed forges or bloomeries, number | 7 |
| Daily capacity of blooms, tons, double turn | 99 |
| Comparison of products: | |
| Number of establishments reporting for both years | 4 |
| Value for census year | $217,774 |
| Value for preceding business year | $180,288 |
| Power: | |
| Number of establishments reporting | 7 |
| Total horsepower | 547 |
| Owned— | |
| Engines— | |
| Steam— | |
| Number | 13 |
| Horsepower | 447 |
| Water wheels— | |
| Number | 2 |
| Horsepower | 100 |
| Establishments classified by number of persons employed, not including proprietors and firm members: | |
| Total number of establishments | 7 |
| 5 to 20 | 4 |
| 21 to 50 | 1 |
| 51 to 100 | 2 |

TABLE 73, PART II.—IDLE FORGES AND BLOOMERIES: BY STATES, 1900.

| | United States. | Maryland. | New Jersey. | North Carolina. | Pennsylvania. |
|---|---|---|---|---|---|
| Number of establishments | 7 | 1 | 1 | 1 | 4 |
| Character of organization: | | | | | |
| Individual | 2 | ..... | 1 | ..... | 1 |
| Incorporated company | 5 | 1 | ..... | 1 | 3 |
| Capital: | | | | | |
| Total | $111,100 | $15,000 | $4,600 | $11,000 | $80,500 |
| Land | $42,100 | $1,000 | $4,000 | $4,000 | $33,100 |
| Buildings | $25,100 | $2,000 | $600 | $5,000 | $17,500 |
| Machinery, tools, and implements | $26,900 | $12,000 | ..... | $1,000 | $13,900 |
| Cash and sundries | $17,000 | ..... | ..... | $1,000 | $16,000 |
| Completed forges or bloomeries, number | 7 | 1 | 1 | 1 | 4 |
| Daily capacity of blooms, tons, double turn | 44¼ | 12 | 8 | ¼ | 24 |

# TIN AND TERNE PLATE.

# TIN AND TERNE PLATE.

By WILLIAM G. GRAY, *Expert Special Agent.*

Tin plates, or, rather, tinned plates, are thin sheets or plates of iron or steel which have been coated by being dipped in a bath of molten tin. They are largely used in the manufacture of household utensils and cans for preserving vegetables, fruit, meat, fish, etc. Iron or steel composes usually from 94 to 98 per cent of the weight of an ordinary box of tin plates. A 100-pound box of best charcoal finished tin plates contains about 6 pounds of coating, while the coating on a 100-pound box of finished coke plates may not weigh over 2½ pounds. The plates are usually packed in wooden boxes.

Terne plates are also thin sheets of iron or steel, but, instead of being dipped in a molten bath of tin alone, a bath containing an alloy of tin and lead is used, the proportion of tin varying from 10 to 33 per cent. A 120-pound box of best grade terne plates contains about 20 pounds of coating, while a box of ordinary grade frequently contains as low as 3 pounds. Terne plates are used wholly for roofing purposes, and are therefore called also roofing plates. On account of the lead used in the bath they are much duller in appearance than tin plates.

There is considerable diversity of opinion as to the exact meaning of the word "terne." Some authorities claim that it means "consisting of three," namely, iron, tin, and lead. The word is derived from the French, however, and means dull or tarnished. The expression "terne plate" was doubtless adopted to distinguish dull plates coated with a mixture of lead and tin from bright plates coated with pure tin. The latter are sometimes called "bright" plates, or, in French, "blanc" plates. In Germany tin plate is known as "weissblech" and terne plate as "mattblech." The word "matt," also means dull.

The base weight of a box of standard tin or terne plates in the United States is 100 pounds; in Great Britain it is 108 pounds.

Black plates are the thin iron or steel sheets from which tin and terne plates are made. They are generally made from Bessemer and open-hearth steel, but a few establishments in the United States sometimes roll iron sheets, to be used almost entirely for fine grades of roofing plates. The quantity made, however, is not very large. The machines and pots used for tinning or coating black plates are called tinning sets.

A majority of the establishments which manufactured tin or terne plates, or both, during the census year, also operated rolling mills, these mills being equipped for the production of the black plates which were coated with tin or with tin and lead in the tin-dipping departments. At some plants, however, tinning pots had not been installed, and black plates or sheets were chiefly produced. Practically all the black plates made by establishments of the latter character were consumed by the tin dipping or stamping works of the country. In any statement, therefore, purporting to give the capital invested, persons employed, wages paid, etc., in the manufacture of tin and terne plates, it would be a manifest error to omit similar data for all establishments engaged in the manufacture of black plates, even though in some instances these plates were not coated with tin or lead by the plants producing them, but were sold to establishments equipped with tinning pots. If such data were omitted from the report on the manufacture of tin and terne plates, a true idea of the magnitude and importance of the industry would not be given.

For these reasons the statistics of the manufacture of tin and terne plates are presented in this report under two heads, the tin and terne dipping industry and the black plate industry. In order to secure a separate statement for each of these industries it has been necessary to divide the reports of all establishments which manufacture the black plates used in their dipping departments.

The statistics given in this report for the tin and terne dipping industry are identical in their totals with the statistics of the tin and terne plate industry, as given in Parts I and II of the Statistics of Manufactures. The statistics of the black plate industry are included, under the general head of iron and steel, in Parts I and II of the Statistics of Manufactures. These statistics are also included in Part III of the Statistics of Manufactures, in the special report on Iron and Steel, where the black plates produced appear among the products of "rolling mills and steel works."

Statistics of the tin and terne dipping and black

plate industries were not separately collected at the census of 1890. It is, therefore, impossible to present comparative figures in any of the statements. The production in 1890 was, however, very small.

The period covered by this report is the census year beginning June 1, 1899, and ending May 31, 1900, or the business year of the establishments reporting which most nearly conforms to this year.

## COMBINED TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES.

Table 1 is a summary of the statistics of the tin and terne dipping and black plate industries.

TABLE 1.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: SUMMARY, 1900.

| | Total. | Tin and terne dipping industry. | Black-plate industry. |
|---|---|---|---|
| Number of establishments | [1] 66 | 57 | 44 |
| Capital | [2] $27,488,302 | $6,790,047 | $20,698,255 |
| Salaried officials, clerks, etc., number | 726 | 333 | 393 |
| Salaries | $818,015 | $291,323 | $526,692 |
| Wage-earners, average number | 14,826 | 3,671 | 11,155 |
| Total wages | $10,288,061 | $1,889,917 | $8,398,144 |
| Men, 16 years and over | 13,798 | 3,014 | 10,784 |
| Wages | $9,996,839 | $1,711,475 | $8,285,364 |
| Women, 16 years and over | 688 | 625 | 63 |
| Wages | $193,834 | $172,568 | $21,266 |
| Children, under 16 years | 340 | 32 | 308 |
| Wages | $97,388 | $5,874 | $91,514 |
| Miscellaneous expenses | $505,128 | $236,456 | $268,672 |
| Cost of materials, including mill supplies, freight, etc | [3] $45,004,716 | $26,728,150 | $18,276,566 |
| Value of products, including custom work and repairing | [3] $61,912,619 | $31,892,011 | $30,020,608 |

[1] Includes 35 plants which manufactured black plates as well as tin and terne plates, 22 plants which manufactured tin and terne plates only, and 9 plants which manufactured black plates only.
[2] Includes *rented property* valued at $165,000.
[3] Includes a duplication of $20,590,566, the value of black plates reported among the products of the black plate industry and used as material in the tin and terne dipping industry.

While it might appear from Table 1 that 101 establishments were engaged during the census year in the combined industries, this was not the case, since establishments which performed both operations, namely, the manufacture of black plates and the dipping of these plates, would thus be counted twice. This will be plain from the following diagram:

9 black plate establishments } The black plate industry (44 establishments).
35 black plate and dipping establishments } The black plate industry (44 establishments).
35 black plate and dipping establishments } The tin and terne dipping industry (57 establishments).
22 dipping establishments } The tin and terne dipping industry (57 establishments).

It thus appears that 35 active dipping establishments, or a majority of the whole number, were equipped also for the manufacture of black plates. In addition, there were 22 active plants equipped for tin and terne dipping only, and 9 active plants equipped for the manufacture of black plates only, or a total of 66 active plants.

The capital invested in the black plate industry was $20,698,255, or 75.3 per cent of the total for the combined industries, and the capital invested in the tin and terne dipping industry was $6,790,047, or 24.7 per cent of the total.

The cost of materials shown for the combined industries includes a duplication of $20,590,566, the value of the black plates produced by black plate establishments and used as material in the tin and terne dipping establishments. It is necessary, therefore, to deduct this sum from the cost of materials shown for the combined industries. In this manner it is found that the approximate cost of all materials consumed in the combined industries during the census year was $24,414,150.

Similarly, in order to obtain a true total value of products, it is necessary to deduct from the total value of products shown for the combined industries the value of the black plates produced by the black plate establishments and used as material in the tin and terne dipping establishments. In this manner it is found that the total value of the products of the combined industries was approximately $41,322,053. In this total, however, there are included products other than black plates or tin and terne plates, valued at $9,660,669.

In these calculations it is assumed that the domestic black plates consumed by the tin and terne plate plants were all produced during the census year. Of course this is not the fact, as a considerable part of the black plates consumed by tin and terne plate plants in the early part of the census year was drawn from stock made in the previous year, while a large part of the black plates produced by domestic mills toward the close of the census year was still in stock, not having been forwarded to the tin and terne plate plants. The figures for cost of materials and value of products for the combined industries are not, therefore, altogether exact. They are, however, approximately correct, and give a fair idea of the importance of the combined industries during the census year.

The average cost per pound of the domestic black plate consumed by tin and terne plate plants in 1900 was 2.49 cents, while the average value of the black plates made by domestic mills during the same year was 2.37 cents, a difference of 12 cents per pound.

Table 2 shows the capital invested in active, idle, and building tin and terne dipping establishments and black-plate establishments during the census year.

TABLE 2.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: CAPITAL INVESTED IN ACTIVE, IDLE, AND BUILDING ESTABLISHMENTS, 1900.

| INDUSTRY. | Number of establishments. | CAPITAL. | | | |
|---|---|---|---|---|---|
| | | Total. | Land. | Buildings, machinery, tools, and implements. | Cash and sundries. |
| Total | [1] 71 | [2] $28,291,883 | $1,949,125 | $15,583,610 | $10,759,148 |
| Tin and terne | 61 | 7,897,531 | 569,125 | 3,012,790 | 3,815,616 |
| Black plate | 47 | 20,894,352 | 1,380,000 | 12,570,820 | 6,943,532 |

[1] Includes 37 plants which were equipped, or were being equipped, for the manufacture of black plates and tin and terne plates; 24 plants which were equipped for the manufacture of tin and terne plates only, and 10 plants which were equipped, or were being equipped, for the manufacture of black plates only.
[2] Includes rented property valued at $165,000.

Table 2 indicates that the most important item of capital was that invested in buildings, machinery, tools, and implements. For the combined industries this amounted to $15,583,610, or 55.1 per cent of the total capital.

In Table 3 the capital invested in active tin and terne dipping and black plate establishments is given separately from the capital invested in idle and building establishments.

TABLE 3.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: CAPITAL INVESTED IN ACTIVE, IDLE, AND BUILDING ESTABLISHMENTS, 1900.

| CLASSES. | Number of establishments. | CAPITAL. | | | |
|---|---|---|---|---|---|
| | | Total. | Land. | Buildings, machinery, tools, and implements. | Cash and sundries. |
| Total | 71 | [1]$28,291,883 | $1,949,125 | $15,583,610 | $10,759,148 |
| Active | 66 | 27,488,302 | 1,895,400 | 15,080,765 | 10,512,137 |
| Idle and building | 5 | 803,581 | 53,725 | 502,845 | 247,011 |

[1] Includes rented property valued at $165,000.

Table 4 shows by states the capital invested in active tin and terne dipping and black plate establishments, together with the number and salaries of the salaried officials, clerks, etc., and the average number and total wages of the wage-earners employed.

TABLE 4.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: ESTABLISHMENTS, CAPITAL, SALARIED OFFICIALS, CLERKS, ETC., AND WAGE-EARNERS, BY STATES, 1900.

| STATES. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | |
|---|---|---|---|---|---|---|
| | | | Number. | Salaries. | Average number. | Total wages. |
| United States. | 66 | [1]$27,488,302 | 726 | $818,015 | 14,826 | $10,288,061 |
| Illinois | 5 | 1,762,162 | 30 | 49,384 | 615 | 459,974 |
| Pennsylvania | 30 | 12,517,557 | 342 | 358,566 | 6,017 | 4,349,327 |
| All other states [2] | 31 | 13,208,583 | 354 | 410,065 | 8,194 | 5,478,760 |

[1] Includes rented property valued at $165,000.
[2] Includes states grouped in order that the operations of individual establishments may not be disclosed, as follows: New York, 4; Maryland, 3; Virginia, 1; West Virginia, 3, Kentucky, 1; Ohio, 12; Indiana, 5; Michigan, 1; Missouri, 1.

During the census year a considerable part of the total production of black plates was consumed by tin dipping plants located in states other than those in which the black plates were produced, and in some instances, establishments manufacturing black plates, as well as tin and terne plates did not produce enough of the former to supply their own tinning plants, and consequently made purchases from mills located in other states. It has been found impracticable, therefore, to give the value of the black plates and tin and terne plates produced during the census year, by states, without more or less duplication. In Pennsylvania, for instance, although black plates amounting in value to $9,423,900 were produced, the domestic black plates consumed by the tin and terne plate plants located in the state amounted in value to only $7,810,211. In Illinois, on the other hand, where black plates valued at only $905,992 were produced, the quantity consumed by the tin and terne dipping plants was valued at $1,367,602. An accurate showing of the Pennsylvania black plate industry requires the crediting to this state of the value of the black plates produced there and sold to tin and terne plate establishments located in other states, even though the value of these black plates reappears in the value of products reported by the establishments, outside of Pennsylvania, which manufactured them into tin or terne plates. For these reasons the cost of materials and the approximate value of products by states have been omitted from Table 4.

Table 5 shows the quantity and cost of the materials used during the census year by the 66 active tin and terne dipping and black plate establishments.

TABLE 5.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: QUANTITY AND COST OF MATERIALS USED, 1900.

| MATERIALS. | Unit of measure. | Quantity. | Cost. |
|---|---|---|---|
| Total | | | [1]$45,004,716 |
| Iron ore | Tons [2] | 1,035 | 6,916 |
| Spiegeleisen, ferromanganese, and all other pig iron | Tons [2] | 16,514 | 253,920 |
| Old iron or steel rails, and other scrap iron or steel | Tons [2] | 34,422 | 592,222 |
| Iron or steel ingots, blooms, tin-plate bars, sheet bars, or slabs | Tons [2] | 648,807 | 13,911,080 |
| Domestic black plates or sheets for tinning | Pounds | 825,556,992 | 20,590,566 |
| Foreign black plates or sheets for tinning | Pounds | 2,358,607 | 78,282 |
| Pig tin | Pounds | 20,282,778 | 4,528,473 |
| Pig lead | Pounds | 6,871,480 | 398,617 |
| Palm oil | Pounds | 5,511,645 | 282,227 |
| Sulphuric acid, tinning flux, bran, and pink meal | | | 187,318 |
| Boxes and nails | | | 303,316 |
| Fuel: | | | |
| Anthracite coal and culm | Tons [1] | 4,456 | 6,465 |
| Bituminous coal and slack | Tons [1] | 598,113 | 619,245 |
| Coke | Tons [1] | 2,645 | 4,628 |
| Charcoal | Bushels | 12,926 | 739 |
| Natural gas | | | 328,388 |
| Oil | Barrels | 50 | 1,061 |
| All other materials, including mill supplies, freight, etc | | | 2,911,253 |

[1] Includes a duplication equal to the cost of the domestic black plates consumed. (See Table I, note 3.)
[2] Tons of 2,240 pounds.

Table 6 shows the approximate value of the products of the tin and terne dipping and black plate establishments. The value of domestic black plates consumed by tin and terne dipping plants has been omitted from the statement, since this item is included in the figures given for finished tin and terne plates. The value of black plates produced by domestic mills, but not consumed by the tin and terne dipping plants during the census year is, however, included in the table.

TABLE 6.—THE TIN AND TERNE DIPPING AND BLACK PLATE INDUSTRIES: APPROXIMATE VALUE OF PRODUCTS, 1900.

| PRODUCTS. | Value. |
|---|---|
| Total | $41,322,053 |
| Products of tin and terne dipping establishments, including tin plates, terne plates, other sheet iron and sheet steel, tinned or terne plated, all other products, and amount received for custom work and repairing | 31,892,011 |
| Products of black plate establishments, omitting the value of black plates consumed by tin and terne dipping plants | 9,430,042 |

In compiling Table 6, it was found impossible to give the exact value of all finished products manufactured by tin and terne plate and black plate establishments during the census year, since duplications of a minor character were more or less unavoidable. The value given for all products is, however, approximately correct. The importance of the two industries, whose growth has been practically confined to a single decade, and which to-day collectively form one of the most vigorous and progressive branches of the iron and steel industry, is strikingly shown in the figures presented. It may be added that since the close of the census year a number of new black plate and tin dipping plants have been built in several states, some of which are now in operation; others are rapidly approaching completion. The outlook for the future growth of the industry is exceptionally bright, as the demand for tin and terne plates will undoubtedly increase year by year as new uses for both products are discovered and developed. It is possible, too, that, as the productive capacity of the domestic tin dipping plants increases, both tin plates and terne plates may form important features of our expanding export trade. A start in this direction has already been made, as shown by the figures of the Treasury Department for the fiscal year ending with June 30, 1901, when 1,367,405 pounds of domestic tin plates, terne plates, and taggers tin were exported, valued at $66,550. Of this total 6,300 pounds, valued at $401, were sent to the United Kingdom.

## THE TIN AND TERNE DIPPING INDUSTRY.

The statistics given in this part of the report relate to the tin and terne dipping industry alone. They do not include data for the rolling-mill departments of plants which manufacture black plates as well as tin and terne plates, or data for establishments which manufacture black plates only. A series of tables giving full and complete details for the black plate industry will be found on pages 11 to 13 of this report.

Table 7 is a summary of the leading statistics of the tin and terne dipping industry for the census year.

TABLE 7.—THE TIN AND TERNE DIPPING INDUSTRY: SUMMARY, 1900.

| | |
|---|---|
| Number of establishments | 57 |
| Capital | [1] $6,790,047 |
| Salaried officials, clerks, etc., number | 333 |
| Salaries | $291,323 |
| Wage-earners, average number | 3,671 |
| Total wages | $1,839,917 |
| Men, 16 years and over | 3,014 |
| Wages | $1,711,475 |
| Women, 16 years and over | 625 |
| Wages | $172,568 |
| Children, under 16 years | 32 |
| Wages | $5,874 |
| Miscellaneous expenses | $236,466 |
| Cost of materials used, including mill supplies, freight, etc | $26,728,150 |
| Value of products, including custom work and repairing | $31,892,011 |

[1] Includes rented property valued at $140,000.

Table 8 gives statistics of the capital invested during and at the close of the census year in active and idle tin and terne dipping establishments, and plants under construction.

TABLE 8.—THE TIN AND TERNE DIPPING INDUSTRY: CAPITAL INVESTED IN ACTIVE, IDLE, AND BUILDING ESTABLISHMENTS, 1900.

| CLASSES. | Number of establishments. | CAPITAL. | | | |
|---|---|---|---|---|---|
| | | Total. | Land. | Buildings, machinery, tools, and implements. | Cash and sundries. |
| Total | 61 | [1] $7,397,531 | $569,125 | $3,012,790 | $3,815,616 |
| Active | 57 | 6,790,047 | 528,400 | 2,634,040 | 3,627,607 |
| Idle and building | 4 | 607,484 | 40,725 | 378,750 | 188,009 |

[1] Includes rented property valued at $140,000.

It appears from Table 8 that a comparatively small amount of the total capital was invested in land, the large items being "buildings, machinery, tools, and implements" and "cash and sundries." Of the 61 establishments enumerated, 45 commenced business between 1890 and 1900 and 2 during the census year. From the remaining 14 no report of the date of commencing business was received. At the close of the census year, only 2 new tin and terne dipping plants were being erected, 1 in Pennsylvania and 1 in Michigan. Of the 2 idle establishments, 1 was located in Pennsylvania and 1 in Ohio.

Table 9 is a summary of the statistics of the 57 active tin and terne dipping establishments for 1900, by states.

TABLE 9.—THE TIN AND TERNE DIPPING INDUSTRY: SUMMARY BY STATES, 1900.

| STATES. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products, including custom work and repairing. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 57 | [1]$6,790,047 | 333 | $291,323 | 3,671 | $1,889,917 | $236,456 | $26,728,150 | $31,892,011 |
| Illinois | 3 | 413,055 | 16 | 19,323 | 166 | 88,061 | 29,993 | 1,778,048 | 2,081,837 |
| New York | 4 | 245,579 | 23 | 23,430 | 55 | 25,399 | 14,058 | 366,409 | 463,199 |
| Ohio | 12 | 1,203,265 | 38 | 33,301 | 697 | 394,676 | 38,963 | 5,012,175 | 6,023,314 |
| Pennsylvania | 25 | 3,042,029 | 189 | 147,202 | 1,578 | 813,692 | 82,169 | 10,364,084 | 12,580,991 |
| All other states [2] | 13 | 1,886,119 | 67 | 68,067 | 1,175 | 568,089 | 71,273 | 9,207,434 | 10,792,670 |

[1] Includes rented property valued at $140,000.
[2] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; Virginia, 1; West Virginia, 2.

Of the 57 establishments shown in Table 9, 50 were operated by incorporated companies, 5 by firms and limited partnerships, and 2 by individuals. Pennsylvania led in the number of establishments, Ohio, Indiana, New York, and Illinois following in the order named. In the number of wage-earners employed, which is a more accurate measure of the importance of the industry, these states stand in the same order except that the relative positions of New York and Illinois are reversed, the former ranking fifth and the latter fourth. It should be noted, however, that the production was large in some of the states included under the head of "all other states." The order given above is, therefore, not strictly a measure of the importance of the industry in the several states. A more satisfactory measure is found in Table 12, where the capacity of the tin and terne dipping establishments is given separately for each state where such establishments existed at the close of the census year. Table 12, however, includes both active and idle establishments. From Table 9 it appears that Pennsylvania and Ohio together reported more than one-half of the total value of products.

Table 10 shows the quantity and cost of materials used during the census year in the 57 active tin and terne dipping establishments.

TABLE 10.—THE TIN AND TERNE DIPPING INDUSTRY: QUANTITY AND COST OF MATERIALS USED, 1900.

| MATERIALS. | Unit of measure. | Quantity. | Cost. |
|---|---|---|---|
| Total | | | $26,728,150 |
| Domestic black plates or sheets for tinning | Pounds | 825,656,992 | 20,590,566 |
| Foreign black plates or sheets for tinning | Pounds | 2,358,607 | 78,282 |
| Pig tin | Pounds | 20,282,778 | 4,528,473 |
| Pig lead | Pounds | 6,871,480 | 398,617 |
| Palm oil | Pounds | 5,611,645 | 282,227 |
| Sulphuric acid, tinning flux, bran, and pink meal | | | 187,318 |
| Boxes and nails | | | 308,316 |
| Fuel: | | | |
| Anthracite coal and culm | Tons [1] | 4,456 | 6,465 |
| Bituminous coal and slack | Tons [1] | 35,048 | 48,059 |
| Coke | Tons [1] | 975 | 2,000 |
| Charcoal | Bushels | 556 | 122 |
| Natural gas | | | 34,110 |
| Oil | | | 700 |
| All other materials, including mill supplies, freight, etc. | | | [2]267,895 |

[1] Tons of 2,240 pounds.
[2] In some cases the cost of freight is included in the cost of materials, it not being practicable to secure the cost of freight separately.

It appears from Table 10 that, aside from the cost reported for black plates, which amounted to 77.3 per cent of the total cost of the materials used, pig tin and pig lead were the most important items. Table 10 indicates, also, that the use of foreign black plates or sheets, which was confined to the states of Pennsylvania and Virginia, was very small compared with the use of domestic black plates and sheets. Bituminous coal and slack, and natural gas were the most important fuels used, in the order named. There were 19 establishments which used natural gas for fuel in whole or in part, located as follows: Pennsylvania, 9; West Virginia, 2; Ohio, 3; and Indiana, 5.

The amount of freight paid on materials consumed was separately reported by a number of establishments, but some of the plants could not give complete reports under this head, since the freight charges were frequently paid by the shippers.

As nearly as can be ascertained, the loss in manufacture of black plates into finished tin or terne plates amounted during the census year to about 10,577,000 pounds, or about 1.2 per cent. In explanation of this loss it might be well to state that at the tin dipping works the finished black plates, before receiving their coating of tin or tin and lead, are white pickled in order that the blue oxide surface may be removed, in which process they lose in weight from one-half to three-quarters of 1 per cent. As a rule, terne plates are resheared or resquared after they are finished, the loss resulting therefrom being about 1.5 per cent.

Of the pig tin and pig lead consumed, about 7 per cent was lost in the process of manufacture. A part of this loss was, however, subsequently recovered from the dross, but at least 2 per cent was totally lost. The palm oil used was almost entirely lost. So, too, were the zinc and muriatic acid from which the chloride of zinc, known as "flux," is made.

In connection with the loss in manufacture above referred to, it may be mentioned that the total loss by the various pickling processes through which the black plates pass from the time they leave the hot rolls until they reach the tinning pots will approximate 4 per cent, over 3 per cent of which is caused by black pickling—that is, the first pickling process after the plates are hot rolled and before they are annealed or cold rolled—

and from one-half to three-quarters of 1 per cent by white pickling. In manufacturing common or light coated plates it is usually assumed by tin plate manufacturers that the loss in weight by the two pickling processes about equals the gain in weight by coating. This is not altogether correct, however, as in the case of heavy coated plates the gain in weight through coating greatly exceeds the loss in weight by pickling.

If to the total cost of materials given in Table 10, $26,728,150, there is added the $291,323 paid to salaried employees, the $1,889,917 paid to wage-earners, and the $236,456 paid for miscellaneous expenses, a total of $29,145,846 is obtained for materials, salaries, wages, and miscellaneous expenses.

Table 11 shows the quantity and value of the tin and terne plates and other products of the 57 active tin and terne dipping establishments, by states, for 1900.

TABLE 11.—THE TIN AND TERNE DIPPING INDUSTRY: QUANTITY AND VALUE OF PRODUCTS, BY STATES, 1900.

| STATES. | Total value. | TIN PLATES. | | TERNE PLATES. | | OTHER SHEET IRON AND SHEET STEEL, TINNED OR TERNE PLATED.[1] | | Value of all other products, including custom work and repairing. |
|---|---|---|---|---|---|---|---|---|
| | | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | |
| United States | $31,892,011 | 707,718,239 | $25,553,021 | 141,285,783 | $5,731,124 | 1,000,473 | $86,492 | $521,374 |
| Illinois | 2,081,837 | 47,296,727 | 1,999,489 | | | 800,000 | 80,000 | 2,348 |
| New York | 463,199 | 5,591,050 | 258,199 | 3,900,000 | 205,000 | | | |
| Ohio | 6,023,314 | 132,163,383 | 4,623,930 | 30,146,921 | 1,176,773 | | | 222,611 |
| Pennsylvania | 12,530,991 | 256,879,332 | 9,137,483 | 77,129,648 | 3,263,769 | 200,473 | 6,492 | 123,247 |
| All other states[2] | 10,792,670 | 265,787,747 | 9,533,920 | 30,109,214 | 1,085,582 | | | 173,168 |

[1] Includes the products of establishments which operate stamping works as well as tin and terne dipping plants. Most of these products are stamped into shape from black plates and then tinned.

[2] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; Virginia, 1; West Virginia, 2.

Table 11 indicates that the production of tin plates was more than four times as great as the production of terne plates. Illinois produced tin plates only, while New York, Ohio, and Pennsylvania produced both tin and terne plates. Tin scrap, tin dross, spelter, etc., are included under the heading of "all other products."

The average value of the tin plates produced was over 3.6 cents per pound; of the terne plates, over 4 cents per pound; and of other sheet iron or sheet steel tinned or terne plated, over 8.6 cents per pound.

Almost all the tin and terne plates made in the United States during the census year were consumed in the home market. The total exports by the manufacturers amounted to only 17,939 pounds, valued at $897, reported entirely by the state of Pennsylvania.

Table 12 gives the daily capacity, on single turn, of the 59 completed active and idle tin and terne dipping plants which were in existence during the census year. A majority of these plants were equipped for the manufacture of both tin and terne plates. Others, however, produced terne plates only, and still others, tin plates only. The capacities of the 2 plants in course of construction are not included.

The rank of the 11 states, shown in Table 12, measured by the total capacity of their active and idle establishments, is as follows:

Pennsylvania, Ohio, Indiana, West Virginia, Illinois, Maryland, Missouri, New York, Kentucky, Virginia, and Michigan. The three states of Pennsylvania, Ohio, and Indiana had almost four-fifths of the total capacity shown, no other state having a capacity of over 155,000 pounds per day.

TABLE 12.—THE TIN AND TERNE DIPPING INDUSTRY: DAILY CAPACITY OF ACTIVE AND IDLE ESTABLISHMENTS, 1900.

| STATES. | Number of establishments. | DAILY CAPACITY (IN POUNDS) SINGLE TURN. | | |
|---|---|---|---|---|
| | | Total. | Tin plates. | Terne plates. |
| United States | 59 | 2,759,901 | 2,018,538 | 741,363 |
| Illinois | 3 | 142,000 | 142,000 | |
| Indiana | 5 | 452,000 | 380,050 | 71,950 |
| Kentucky | 1 | 10,600 | 5,300 | 5,300 |
| Maryland | 2 | 120,000 | 120,000 | |
| Michigan | 1 | 3,000 | 3,000 | |
| Missouri | 1 | 100,000 | 100,000 | |
| New York | 4 | 47,800 | 27,800 | 20,000 |
| Ohio | 13 | 500,500 | 358,500 | 142,000 |
| Pennsylvania | 26 | 1,220,001 | 806,888 | 413,113 |
| Virginia | 1 | 10,000 | | 10,000 |
| West Virginia | 2 | 154,000 | 75,000 | 79,000 |

A number of the tin dipping plants run on single turn only, each turn being, on an average, ten hours. At other plants, however, especially those which produce their own black plates, double and triple turn is the practice, two and three sets of skilled workmen being employed. Based upon double turn, the capacity of the completed works for tin plates alone, including the two idle plants, was 4,037,076 pounds daily, or, allowing 300 working days for each year, 1,211,122,800 pounds annually, and for terne plates, 1,482,726 pounds daily, or 444,817,800 pounds annually. The total yearly capacity for the two products on double turn is thus found to be 1,655,940,600 pounds. These capacities are, of course, largely theoretical, as it would be almost a physical impossibility to operate all the tinning sets in the country at the same time and on double turn. The

figures serve, however, to show the total quantity of tin and terne plates that could be turned out in the United States in a single year if the operation of all the plants on double turn for all the working days in the year were practicable.

Of the 59 active and idle completed tin and terne plate plants enumerated above, 15 plants were equipped for the manufacture of tin plates only, 9 plants for the manufacture of terne plates only, and 35 plants for the manufacture of both tin and terne plates. The 15 plants equipped for the manufacture of bright plates only were distributed as follows: Illinois, 3; Maryland, 2; Michigan, 1; Missouri, 1; New York, 3; Ohio, 1; and Pennsylvania, 4. The 9 plants equipped for the manufacture of terne plates only were located as follows: New York, 1; Ohio, 3; Pennsylvania, 4; and Virginia, 1. The 35 plants equipped for the manufacture of both tin and terne plates were distributed as follows: Indiana, 5; Kentucky, 1; Ohio, 9; Pennsylvania, 18; and West Virginia, 2.

Table 13 shows the number of establishments and the number of completed and building sets for tin and terne dipping in each state at the close of the census year.

TABLE 13.—THE TIN AND TERNE DIPPING INDUSTRY: TINNING SETS, COMPLETED AND BUILDING, BY STATES, 1900.

| STATES. | Number of establishments. | NUMBER OF SETS. | | |
|---|---|---|---|---|
| | | Total. | Completed. | Building. |
| United States | [1]59 | 638 | 585 | 53 |
| Illinois | 3 | 30 | 30 | ..... |
| Indiana | 4 | 92 | 84 | 8 |
| Kentucky | 1 | 4 | 4 | ..... |
| Maryland | 2 | 21 | 21 | ..... |
| Michigan | 2 | 13 | 4 | 9 |
| Missouri | 1 | 17 | 15 | 2 |
| New York | 4 | 13 | 13 | ..... |
| Ohio | 13 | 119 | 103 | 16 |
| Pennsylvania | 26 | 303 | 285 | 18 |
| Virginia | 1 | 3 | 3 | ..... |
| West Virginia | 2 | 23 | 23 | ..... |

[1] Does not include 2 establishments—1 in Indiana and 1 in Pennsylvania—which were active during the census year, but from which the tinning pots were removed before the close of the year.

If the 2 plants in process of erection are deducted from the total given in Table 13, it will be found that at the close of the census year there were only 57 completed plants in the United States which were equipped for the manufacture of tin plates or terne plates, or both. The tinning pots in the 2 plants in course of construction are, of course, included in Table 13.

Table 13 indicates that there were 303 completed and building tinning sets (285 completed and 18 building) located in Pennsylvania at the close of the census year—almost one-half of the total number for the United States; that there were 119 sets in Ohio (103 completed and 16 building); and 92 sets in Indiana (84 completed and 8 building). Almost five-sixths of the total number of tinning sets in the United States were located in these three states. In point of equipment Illinois ranked fourth, with 30 sets; West Virginia fifth, with 23 sets; Maryland sixth, with 21 sets; and Missouri seventh, with 17 sets (15 completed and 2 building). There were 13 sets in New York, all completed; 13 sets in Michigan, only 4 of which were completed; 4 completed sets in Kentucky; and 3 completed sets in Virginia.

Table 14 shows, by states, the number of months the tin and terne dipping establishments were in operation during the census year.

TABLE 14.—THE TIN AND TERNE DIPPING INDUSTRY: NUMBER OF ESTABLISHMENTS AND MONTHS IN OPERATION, BY STATES, 1900.

| STATES. | Number of establishments. | Months on full time. | Months on three-fourths time. | Months on half time. | Months on one-fourth time. | Months idle. |
|---|---|---|---|---|---|---|
| United States | 57 | 489 | 39 | 29 | 5 | 122 |
| Illinois | 3 | 33 | ..... | ..... | ..... | 3 |
| Indiana | 5 | 43 | ..... | ..... | ..... | 17 |
| Kentucky | 1 | ..... | 12 | ..... | ..... | ..... |
| Maryland | 2 | 24 | ..... | ..... | ..... | ..... |
| Michigan | 1 | ..... | 12 | ..... | ..... | ..... |
| Missouri | 1 | 12 | ..... | ..... | ..... | ..... |
| New York | 4 | 31 | 5 | 5 | ..... | 7 |
| Ohio | 12 | 102 | 2 | 9 | 1 | 30 |
| Pennsylvania | 25 | 214 | 5 | 14 | 2 | 65 |
| Virginia | 1 | 7 | 2 | 1 | 2 | ..... |
| West Virginia | 2 | 23 | 1 | ..... | ..... | ..... |

If each of the 57 tin and terne dipping plants which were active during the census year had run for 12 consecutive months on full time the total number of months of operation would have been 684. As a matter of fact, however, although several of the establishments ran on full time for 12 months, some ran for several months on three-fourths, one-half, and one-fourth time, and others were idle for one, two, three, or more months. If the 57 establishments are considered as one plant and their working period as 684 months, it appears from Table 14 that they were operated on full time 489 months; on three-fourths time 39 months; on one-half time 29 months; on one-fourth time 5 months; and were idle 122 months.

Applying the same rule to the various states, it appears that out of a possible 36 months of running time, the 3 plants in Illinois were operated 33 months on full time and were idle 3 months. Out of 60 months of running time, the 5 Indiana plants were operated on full time 43 months and were idle 17 months. The single plant in Kentucky ran 12 months on three-fourths time. The 2 plants in Maryland were operated 12 months each on full time. The single plant in Michigan ran 12 months on three-fourths time and the single plant in Missouri 12 months on full time. The 4 plants in New York, out of a possible 48 months, ran on full time 31 months, on three-fourths time 5 months, on half time 5 months, and were idle 7 months. The 12 plants in Ohio, out of a possible 144 months, ran 102 months on full time, 2 months on three-fourths time, 9 months on

half time, 1 month on one-fourth time, and were idle 30 months. If the 25 plants in Pennsylvania had run for 12 months each they would have been in operation 300 months. It appears from the returns, however, that they were idle 65 months, and in operation on full time 214 months, on three-fourths time 5 months, on half time 14 months, and on one-fourth time 2 months. The single plant in Virginia ran on full time 7 months, on three-fourths time 2 months, on half time 1 month, and on one-fourth time 2 months. The 2 plants in West Virginia ran 23 months on full time out of a possible 24 months, and 1 month on three-fourths time.

In the above statement no account has been taken of overtime. A number of plants in several states ran both night and day for various periods during the census year, the number of extra hours reported for "overtime" amounting to 8,457.

The production of tin and terne plates from July 1, 1891, to December 31, 1901, was as follows:

| | Pounds. |
|---|---|
| 1891 (last six months) | 2,236,743 |
| 1892 | 42,119,192 |
| 1893 | 123,606,707 |
| 1894 | 166,343,409 |
| 1895 | 254,611,395 |
| 1896 | 359,209,798 |
| 1897 | 574,779,000 |
| 1898 | 732,289,000 |
| 1899 | 808,360,000 |
| 1900 | 677,969,000 |
| 1901 | 894,411,000 |

From July 1, 1891, to June 30, 1897, these statistics were collected by Col. Ira Ayer, special agent of the Treasury Department. For the last six months of 1897 and for the whole of 1898 they were collected by the editor of the "Metal Worker," of New York City, and from 1899 to 1901, inclusive, they were collected by the American Iron and Steel Association, of Philadelphia.

Detailed statistics of the tin and terne dipping industry are presented in Tables 21 and 22, which appear at the end of this report. The statistics for each state are summarized in the following paragraphs. In cases where less than three tin or terne plate plants were located within a state, or where all the plants in a state were operated by a single company, it has been necessary, in order that the operations of individual establishments may not be disclosed, to include the statistics with those for another state.

There were 25 establishments in Pennsylvania engaged in the tin and terne dipping industry, with an aggregate capital of $3,042,029. The average number of wage-earners employed was 1,578, and the value of products, $12,530,991. These products included 256,879,332 pounds of tin plates valued at $9,137,483, 77,129,648 pounds of terne plates valued at $3,263,769, 200,473 pounds of other sheet iron or sheet steel, tinned or terne plated, valued at $6,492, and miscellaneous products valued at $123,247. Pennsylvania apparently enjoys the distinction of being the only state from which tin and terne plates were exported by the manufacturers during the census year. The quantity reported was 17,939 pounds, valued at $897. The kinds and cost of fuel used were as follows: Anthracite coal and culm, $5,585; bituminous coal and slack, $16,038; coke, $100; and natural gas, $18,778.

Since the 5 establishments in operation in Indiana were all under the management of a single company, the statistics of capital invested, the cost of materials used, and the value of products have been included with similar data for the state of Illinois. All the 5 Indiana establishments produced both tin and terne plates. In reaching a total for the establishments in the state, each of the 5 plants operated by the single company above referred to has been counted as one establishment. The average number of wage-earners employed during the year was 572, and the daily capacity on single turn of the 5 establishments was 380,050 pounds of tin plates and 71,950 pounds of terne plates. Indiana was the only state which used natural gas exclusively for fuel in the manufacture of tin and terne plates during the census year, not one of the 5 establishments reporting the consumption of a single ton of coal.

During the census year there were 3 establishments in Illinois engaged in the tin dipping industry. Terne plates were not made. The average number of wage-earners employed during the year was 166, and the daily capacity of the 3 establishments was 142,000 pounds of tin plates. The capital invested in the 8 tin and terne plate plants in Indiana and Illinois was $1,117,184, and the value of products, $8,347,155. These products included 231,992,162 pounds of tin and terne plates, valued at $8,248,445; 800,000 pounds of other sheet iron or sheet steel, tinned or terne plated, valued at $80,000; and tin and terne dross, scruff, etc., valued at $18,710. For fuel, bituminous coal and slack, oil, and natural gas were used. The oil and the bituminous coal and slack were reported entirely by Illinois, and the natural gas by Indiana.

There were 12 completed tin and terne dipping establishments in Ohio at the close of the census year, with a total capital of $1,203,265. The average number of wage-earners employed during the year was 697, and the value of products, $6,023,314. These products included 132,163,383 pounds of tin plates valued at $4,623,930, 30,146,921 pounds of terne plates valued at $1,176,773, and miscellaneous products, including custom work and repairing, valued at $222,611. The kinds and cost of fuel used were as follows: Bituminous coal and slack, $7,352, and natural gas, $7,037.

As Maryland and West Virginia had each only 2 tin and terne dipping establishments in operation during the census year, it is necessary to combine the data for the two states to avoid disclosing the operations of individual establishments. The 4 establishments located in these two states reported a total capital of $586,182.

The average number of wage-earners employed was 274, and the value of products, $2,650,708. These products included 67,721,725 pounds of tin and terne plates valued at $2,632,992. In addition, miscellaneous products to the value of $16,816 were reported and custom work and repairing to the value of $900. The establishments in Maryland made tin plates only.

During the census year there were 4 tin and terne dipping establishments in operation in the state of New York, with an aggregate capital of $245,579. The average number of wage-earners employed during the year was 55, and the value of products, $463,199. These products included 5,591,050 pounds of tin plates valued at $258,199, and 3,900,000 pounds of terne plates valued at $205,000. So far as could be learned, none of the tin or terne plates made in the state of New York during the census year were exported by the manufacturers. The kinds and cost of fuel used were as follows: Anthracite coal and culm, $880; bituminous coal and slack, $1,525; and charcoal, $70.

In each of the states of Virginia, Kentucky, Michigan, and Missouri only 1 tin or terne plate plant was in operation during the census year. In addition, 1 plant for the manufacture of both tin and terne plates was being erected in Michigan on May 31, 1900. These 5 establishments reported a total capital of $1,050,067. The average number of wage-earners employed during the year was 329, and the value of products, $1,876,644. These products included 43,479,801 pounds of tin and terne plates—mostly tin plates—valued at $1,737,554; miscellaneous products valued at $118,290; and custom work and repairing amounting to $20,800. Of the 4 establishments in operation, 2 made terne plates and 2 made tin plates. The Michigan establishment consumed its entire product in its own works in the manufacture of various specialties. The 3 remaining establishments sold their output in whole or in part in the general market. Virginia and Kentucky made terne plates only, and Michigan and Missouri made tin plates only. The kinds and cost of fuel used were as follows: Bituminous coal and slack, $10,628; coke, $1,900; and charcoal, $2.

## THE BLACK PLATE INDUSTRY.

The statistics given in this part of the report relate, as a rule, to those establishments which make a specialty of the manufacture of black plates for tinning. In some cases, however, where the total output includes products other than black plates, it has been found impracticable to separate the capital invested, wages paid, persons employed, etc., in the production of these miscellaneous products, from the corresponding items for the production of black plates alone. The former data are therefore included with the latter in all the statistics which follow. It will be noticed, however, that the value given for "other products" is not large compared with the value of the black plates reported. It may be added that plates and sheets other than black plates for tinning formed about one-half of the value reported for "other products."

Table 15 is a summary of the statistics for the 44 establishments which were engaged in whole or in part in the black plate industry during the census year.

TABLE 15.—THE BLACK PLATE INDUSTRY: SUMMARY, 1900.

| | |
|---|---|
| Number of establishments | 44 |
| Capital | [1]$20,698,255 |
| Salaried officials, clerks, etc., number | 393 |
| Salaries | $526,692 |
| Wage-earners, average number | 11,155 |
| Total wages | $8,398,144 |
| Men, 16 years and over | 10,784 |
| Wages | $8,285,364 |
| Women, 16 years and over | 63 |
| Wages | $21,266 |
| Children, under 16 years | 308 |
| Wages | $91,514 |
| Miscellaneous expenses | $268,672 |
| Cost of materials used | $18,276,566 |
| Value of products | $30,020,608 |

[1] Includes rented property valued at $25,000.

In addition to the 44 completed black plate establishments in operation during the census year, 3 establishments were in course of construction on May 31, 1900. The capital invested at the close of the census year in both active and building establishments is given in detail in Table 16.

TABLE 16.—THE BLACK PLATE INDUSTRY: CAPITAL INVESTED IN ACTIVE AND BUILDING ESTABLISHMENTS, 1900.

| CLASSES. | Number of establishments. | CAPITAL. | | | |
|---|---|---|---|---|---|
| | | Total. | Land. | Buildings, machinery, tools, and implements. | Cash and sundries. |
| Total | 47 | [1]$20,894,352 | $1,380,000 | $12,570,820 | $6,943,532 |
| Active | 44 | 20,698,255 | 1,367,000 | 12,446,725 | 6,884,530 |
| Building | 3 | 196,097 | 13,000 | 124,095 | 59,002 |

[1] Includes rented property valued at $25,000.

Table 16 indicates that the most important item of capital reported for this industry is that invested in buildings, machinery, tools, and implements.

Table 17 presents the statistics of the industry for 1900, by states.

The 44 establishments included in Table 17 were located in 8 states, as follows: Pennsylvania, 22; Ohio, 9; Indiana, 5; Illinois, 3; West Virginia, 2; and Maryland, Kentucky, and Missouri, 1 each. Thus, one-half of the total number of black-plate plants in operation during the census year was located in Pennsylvania, and more than three-sevenths of the total capital reported was invested in the plants located in that state.

TABLE 17.—THE BLACK PLATE INDUSTRY: SUMMARY, BY STATES, 1900.

| STATES. | Number of establishments. | Capital. | SALARIED OFFICIALS, CLERKS, ETC. | | WAGE-EARNERS. | | Miscellaneous expenses. | Cost of materials used. | Value of products. |
|---|---|---|---|---|---|---|---|---|---|
| | | | Number. | Salaries. | Average number. | Total wages. | | | |
| United States | 44 | $20,698,255 | 393 | $526,692 | 11,155 | $8,398,144 | $268,672 | $18,276,566 | $30,020,608 |
| Illinois | 3 | 1,349,107 | 14 | 30,061 | 449 | 371,913 | 26,621 | 933,624 | 1,537,125 |
| Pennsylvania | 22 | 9,475,528 | 153 | 211,364 | 4,439 | 3,595,635 | 66,948 | 6,708,650 | 11,147,659 |
| All other states[1] | 19 | 9,873,620 | 226 | 285,267 | 6,267 | 4,490,596 | 175,103 | 10,634,292 | 17,335,824 |

[1] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 1; Missouri, 1; Ohio, 9, 8 of which are controlled by one company; West Virginia, 2.

TABLE 18.—THE BLACK PLATE INDUSTRY: QUANTITY AND COST OF MATERIALS USED, 1900.

| MATERIALS. | Unit of measure. | Quantity. | Cost. |
|---|---|---|---|
| Total | | | $18,276,566 |
| Iron ore | Tons[1] | 1,035 | 6,916 |
| Pig iron, spiegeleisen, and ferromanganese | Tons[1] | 16,514 | 253,920 |
| Old iron or steel rails and other scrap iron or steel | Tons[1] | 34,422 | 592,222 |
| Iron or steel ingots, blooms, billets, tin-plate bars, sheet bars, and slabs | Tons[1] | 648,807 | 13,911,080 |
| Fuel: | | | |
| Bituminous coal and slack | Tons[1] | 563,065 | 571,186 |
| Coke | Tons[1] | 1,670 | 2,628 |
| Charcoal | Bushels | 12,370 | 617 |
| Natural gas | | | 294,278 |
| Oil | Barrels | 50 | 361 |
| All other materials, including mill supplies, freight, etc. | | | 2,643,358 |

[1] Tons of 2,240 pounds.

Table 18 indicates that the cost of iron or steel ingots, blooms, billets, tin plate bars, sheet bars, or slabs amounted to $13,911,080, out of a total cost of $18,276,566 for all materials. The most important fuels used were "bituminous coal and slack," costing $571,186, or a little over $1 a ton, and natural gas, costing $294,278. During the census year 15 establishments used natural gas for fuel, in whole or in part, located as follows: Indiana, 5; Ohio, 2; Pennsylvania, 6; and West Virginia, 2.

The iron ore, pig iron, spiegeleisen, and ferromanganese reported in Table 18 were consumed by establishments which produced steel ingots and muck bars as well as black plates for tinning. The charcoal reported was consumed by 1 establishment in Pennsylvania which operated a bloomery for the production of charcoal blooms, all of which were subsequently manufactured into finished products in its rolling mill.

Table 19 shows, by states, the quantity and value of the products turned out by the 44 active black plate establishments during the census year.

TABLE 19.—THE BLACK PLATE INDUSTRY: QUANTITY AND VALUE OF PRODUCTS, BY STATES, 1900.

| STATES. | Total value. | BLACK PLATES. | | | | | | ALL OTHER PLATES AND SHEETS. | | Value of all other products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total. | | Bessemer steel. | | Open-hearth steel. | | Tons. | Value. | |
| | | Tons. | Value. | Tons. | Value. | Tons. | Value. | | | |
| United States | $30,020,608 | 394,014 | $20,967,805 | 355,077 | $18,673,311 | 38,937 | $2,294,494 | 79,096 | $4,517,644 | $4,535,159 |
| Illinois | 1,537,125 | 14,491 | 905,992 | 6,906 | 396,280 | 7,585 | 509,712 | | | 631,133 |
| Pennsylvania | 11,147,659 | 178,574 | 9,423,900 | 169,464 | 9,012,437 | 9,110 | 411,463 | 23,547 | 1,296,279 | 427,480 |
| All other states[1] | 17,335,824 | 200,949 | 10,637,913 | 178,707 | 9,264,594 | 22,242 | 1,373,319 | 55,549 | 3,221,365 | 3,476,546 |

[1] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 1; Missouri, 1; Ohio, 9, 8 of which are controlled by one company; West Virginia, 2.

Table 19 indicates that more than nine-tenths of the black plates manufactured were made from Bessemer steel, and less than one-tenth from open-hearth steel. No iron black plates were reported by any of the 44 active establishments. The average value of all kinds of black plates for tinning was $53.21 per ton. The Bessemer black plates averaged $52.59 per ton and the open-hearth black plates $58.93 per ton. The value of all billets and sheet and tin plate bars produced for sale by black plate establishments, which amounted approximately to $1,894,000, is included in the "value of all other products."

Changing gross tons to pounds, it is found that the total production of Bessemer and open-hearth steel black plates in 1900 was 882,591,360 pounds, of which 795,372,480 pounds were Bessemer steel and 87,218,880 pounds were open-hearth steel. These figures do not include the 79,096 tons of plates and sheets other than black plates produced by black plate mills during the census year.

Pennsylvania ranked first in the production of Bessemer steel black plates during the census year, producing almost one-half of the total quantity. Indiana was second, Ohio third, and West Virginia fourth. These four states made over 96 per cent of the total production of Bessemer steel black plates. Pennsylvania, Ohio,

and West Virginia also produced almost all of the 79,096 tons of other plates and sheets reported above, Ohio ranking first, Pennsylvania second, and West Virginia third. In the production of open-hearth steel black plates, Missouri ranked first, Pennsylvania second, Illinois third, and Ohio fourth. These four states produced over 96 per cent of the total production of open-hearth plates.

Table 20 shows the number of hot and cold mills, completed and building, in the 47 establishments, completed and building, during the census year. This table also shows the annual capacity of the hot mills in finished black plates. As a rule the capacities are reported on triple turn.

TABLE 20.—THE BLACK PLATE INDUSTRY: ACTIVE AND BUILDING MILLS, 1900.

| STATES. | Number of establishments. | Number of hot mills. | Number of cold mills. | Annual capacity of hot mills in gross tons.[1] |
|---|---|---|---|---|
| United States | 47 | 355 | 308 | 692,725 |
| Illinois | 3 | 28 | 12 | 50,700 |
| Indiana | 5 | 53 | 38 | 102,025 |
| Kentucky | 1 | 3 | 2 | 5,000 |
| Maryland | 1 | 5 | 3 | 9,625 |
| Michigan | 1 | 4 | 4 | 7,700 |
| Missouri | 1 | 10 | 10 | 18,000 |
| Ohio | 9 | 68 | 63 | 131,850 |
| Pennsylvania | 24 | 170 | 162 | 340,575 |
| West Virginia | 2 | 14 | 14 | 27,250 |

[1] Tons of 2,240 pounds.

Table 20 indicates that there were 355 completed and building hot black plate mills located in the 44 active and 3 building establishments. Of these mills, 332 were completed and 23 were building. The total annual capacity of all the hot mills, both completed and building, was 692,725 gross tons of finished black plates. The completed mills had a capacity of 641,450 tons and the building mills a capacity of 51,275 tons. The number of cold mills was 308, of which 294 were completed and 14 were building. The hot and cold mills in course of construction were located in Pennsylvania, Ohio, and Michigan.

In point of equipment and capacity, Pennsylvania was first, with 170 hot mills (160 completed and 10 building) and 162 cold mills (157 completed and 5 building). The hot mills had an annual capacity of 340,575 gross tons of finished black plates (completed mills, 314,325 tons, and building mills, 26,250 tons). Ohio was second, with 68 hot mills (59 completed and 9 building), having an annual capacity of 131,850 tons of black plates (completed mills, 114,525 tons, and building mills, 17,325 tons) and 63 cold mills (58 completed and 5 building). Indiana was third, with 53 completed hot mills, having an annual capacity of 102,025 tons, and 38 cold mills. Illinois was fourth, with 28 completed hot mills, with an annual capacity of 50,700 tons of black plates, and 12 cold mills. None of the other states named in the table had more than 14 hot mills or an annual capacity exceeding 28,000 tons of finished black plates.

## HISTORY OF THE MANUFACTURE OF TIN AND TERNE PLATES.

### FOREIGN COUNTRIES.

Flower, in his "History of the Trade in Tin," states that brass, which is an alloy of tin and copper, was used by the ancients, in the proportion of one part of tin to nine of copper. He is in doubt as to the source from which the ancients obtained their supply of tin, but inclines strongly to the belief that it came from Cornwall, in England, although he concedes that it may have been brought to Tyre and other cities in Phœnicia from China, whose civilization dates back to at least 2500 B. C. He also states that tin was employed at a very early period for coating iron and copper vessels, but gives no account of the process employed. He quotes Pliny (A. D. 23) as an authority, and is inclined to the opinion that the vessels were dipped in a bath of molten tin as at the present day.

Modern writers practically agree that the art of coating iron sheets or plates with tin was first practiced commercially by the people of Bohemia, tin ore having been discovered in the mountains of that country about the year 1240 A. D. Flower states specifically that the manufacture of tin plates was begun in Bohemia between the years 1240 and 1600, but adds that the town or village where it originated and the year when the first tin plates were made are unknown. But that the coating of iron sheets with tin was carried on exclusively in Bohemia for many years prior to 1620, and that the process of manufacture was strictly guarded by those engaged in it, are beyond doubt. Down to the year last named, not only England but the whole of Europe was dependent upon Bohemia for its supply of tin-coated sheets. In 1620, however, the reigning Duke of Saxony obtained the secret which the Bohemians had carefully guarded for so many years, and immediately erected works in his domain for the manufacture of tin plates. A flourishing industry was soon established and many thousand workmen were given employment. The plates were sent by land and river to Hamburg, whence they were forwarded by sea "as far as trade was known."

Although tin had been smelted for centuries in England from ore mined in Cornwall, and a large trade in pig tin had been established with other European countries for hundreds of years, it was not until about 1670 that tin plates were experimentally produced in Great

Britain. An English gentleman, Andrew Yarranton, had been sent to Saxony in 1665 by a company of English noblemen and gentlemen for the express purpose of acquiring the art of coating iron sheets with tin. After spending some time in Saxony, where he was treated with the utmost civility, and was allowed to study the process of manufacture and to examine carefully the different materials used in making tin plates, he returned to England and established a small plant at Pontypool, in Monmouthshire. The enterprise was not a commercial success, because a patent for the manufacture of tin plates was granted to a high court official, who, it is said, had no knowledge whatever of the process of manufacture. The works at Pontypool were soon abandoned, and for a half century longer Germany and Bohemia continued to enjoy the monopoly they had so long maintained. About 1720 Maj. John Hanbury, an ironmaster of Pontypool, took up the manufacture of tin plates where it had been dropped by Yarranton. His enterprise was successful from the start, and it is not too much to claim that to Major Hanbury belongs the honor of establishing on British soil the first permanent plant for the production of tin plates.

Until 1728 all iron plates had been produced under the hammer, and, as a result, the thickness of the sheets was far from uniform. But in that year the art of producing sheets of uniform thickness by means of rolls was invented, the honor of the invention being claimed by both Major Hanbury and John Payne. By this process the cost of producing iron sheets for tinning was greatly reduced and a flourishing trade was soon established on English soil, the rolled British plates, because of their superior quality and finish, largely displacing in the home market the somewhat crude hammered product of the German manufacturers.

Soon after 1720 the manufacture of tin plates was begun at a number of points in Wales, especially at locations where good waterpower was available and where forges had already been established for the manufacture of charcoal iron. From 1720 to 1834 the growth of the tin plate industry in England and Wales was slow but steady. During the latter year the total production in the two countries was about 180,000 boxes of 108 pounds each, and the value of the exports about $1,640,000. After 1834 the industry grew more rapidly. In 1848 the production was 420,000 boxes, and the value of the exports over $2,442,000; and by 1860 the production had reached 1,700,000 boxes, and the exports were valued at $7,547,000. The growth of the industry was confined almost entirely to the counties of Glamorgan and Carmarthen, in Wales. In 1870 the production advanced to 3,459,782 boxes, but in 1876 it fell to 2,815,393 boxes. Soon after 1876 it again revived, and advanced rapidly from that year to 1890, reaching a total of over 9,500,000 boxes in the latter year. The magnitude of the export trade of Great Britain in tin and terne plates a few years ago is indicated by the imports into the United States, since, prior to 1892, this country obtained practically its entire supply from the United Kingdom. In 1889 the United States imported 742,136,000 pounds, valued at the port of shipment at $21,726,707; and in 1891 about 734,455,000 pounds, valued at $25,900,305. The total value of the tin and terne plates imported into the United States from 1871 to 1891, inclusive, was $333,241,709, an average of $15,868,652 annually. From 1892 to 1900, inclusive, the total value was $78,372,484, an average of $8,708,053 annually. In the year last named the total imports were only 135,264,881 pounds, valued at $4,617,813.

About the time of the failure of Andrew Yarranton to establish the manufacture of tin plates in England, and perhaps prior thereto, several similar attempts were made in France, all of which failed. About 1714, however, a plant was erected at Mansvaux, in Alsace, for the manufacture of tin plates and was successfully operated. This was at least six years prior to the revival of the industry at Pontypool, in England. A plant was established at Bains, in Lorraine, in 1733; another at Imphy, near Nevers, in 1745; and still another at Morambeau, in Franche Comté, in 1751. France still manufactures tin plates, but the quantity produced is not large. Works are said to be in operation in Bohemia, also, the original home of the industry, and in Moravia and Styria. Considerable quantities are produced in Westphalia and in Rhenish Prussia, but until recent years, when the industry became firmly established in the United States, the chief source of the world's supply was England and Wales, about five-sixths of the total production of these two countries being exported.

Iron plates coated with an alloy of tin and lead were used early in the Nineteenth and probably also in the Eighteenth century in Germany and France in the manufacture of painted, decorated, and lacquered ware, such as salvers, tea trays, botanists' drums, sandwich boxes, pencil cases, bird cages, etc., the surface of which was covered with paint and pictures. For such uses the lead alloy was cheaper than tin and answered the purpose as well. It does not appear, however, that sheets coated with an alloy of tin and lead were used for roofing purposes by either of the countries named until long after the beginning of the Nineteenth century.

Prior to the manufacture of terne plates for roofing, tin plates 10 by 14 inches in size were frequently used for that purpose. As a rule, heavy plates were used, corresponding to what is commercially known as 2x, or about No. 27 gauge. One of the leading tin plate manufacturers of Pennsylvania states that many years ago a number of roofs in Philadelphia were covered with tin plates instead of terne plates, and that the plates on these roofs are to-day in almost as good condition as when first laid. The plates used, however, were very heavily coated with tin. In the United States, during the period following the Civil War, large quantities of

tin plates were sold for roofing purposes throughout the West, especially in the dry, mountainous districts. Some thirty or forty years ago tin plates were largely used for roofing purposes in Canada. These plates, which were unpainted and shone out brilliantly in the sun, cost in those days from $10 to $12 per box. Some of the tin plates placed on roofs in Quebec and other Canadian cities over three-quarters of a century ago are still in good condition. The roofs of Quebec are exceedingly steep, which may account in part for the great durability of the plates. At the present time the practice in the large Canadian cities is to use galvanized sheets for roofing purposes. It is claimed that sheets of this character last from twenty to thirty-five years without repairs. The gauges used are Nos. 26 and 28. About 20 per cent of the quantity annually consumed in Canada is imported from the United States. The remainder is obtained from Great Britain. Small quantities of imported English black plates are also used on very steep roofs. If painted every year, these sheets are said to last for about fifteen or twenty years. No. 28 gauge is the thickness generally used. Considerable quantities of terne plates are still used in the rural districts.

### THE UNITED STATES, PRIOR TO 1890.

Diligent search has failed to bring to light any record of the production of terne plates for roofing purposes in any country prior to 1830. In that year small quantities of lead-coated sheets were made in an establishment located on Market street, Philadelphia, Pa., and used for covering roofs. It is, of course, possible that England, Wales, Germany, or France produced roofing plates coated with tin and lead much earlier than the year named. If such is the case, however, the date of their manufacture and the country in which they were made seems not to be known.

Flower, in his "History of the Trade in Tin," does not mention the year when terne plates were first produced nor the country in which they were manufactured, although he is strongly inclined to the opinion that they were made in France before they were made in England. As early as 1848 reference to the manufacture in Great Britain of plates of "dull appearance" was made by Mr. Thomas William Booker, high sheriff of Glamorganshire, in an address on the tin plate industry of Monmouthshire, Glamorganshire, and Carmarthenshire, delivered before the Royal British Association at its annual meeting at Swansea, in Wales, in the year named. He referred to the depression at that time existing in the tin plate trade, and in the course of his remarks said that the works located in the district mentioned could produce not less than 520,000 boxes of tin plates annually, and that "a small proportion of the plates manufactured are of dull appearance. These are for a special purpose, lead being used in the manufacture." As far as can be learned, he made no mention of the word "terne." As three years later, however, in 1851, "tin and terne plates" appear in the list of exports from Great Britain, it is reasonable to assume that the "dull plates" mentioned by Mr. Booker were iron plates coated with a mixture of tin and lead, although they may have been coated with lead only. No mention of terne plates is apparently made in the iron and steel exports from Great Britain in 1848.

The plates made in the Philadelphia establishment were 10 by 14 inches, the standard commercial size in those days. Imported English tin plates were used instead of black plates. They were first put together and run through a bath of molten lead, the tin on the plates serving as a holder for the lead. The plates were sold for roofing purposes and were of excellent quality. The quantity produced, however, was not very large. Regarding the sale of these plates, the N. & G. Taylor Company, of Philadelphia, says: "News of the sale of so novel an article soon found its way across the water, and terne plates commenced to be made there." Very few terne plates are used for roofing purposes in Europe, zinc sheets being commonly used instead. The manufacture of terne plates did not become an important branch of the tin plate industry until America began to use this material for covering roofs.

The manufacture of household and culinary articles from sheet metal has been carried on in the United States for many years. Tin plates and iron black plates were chiefly used for this purpose, the articles being stamped from a single blank. At first only shallow articles were made, such as pie plates and pot covers, but about 1860 a machine was devised for the manufacture of deeper wares, such as milk pans, washbowls, cake pans, and, finally, dish pans. Tin plates were largely used in the production of all of the articles named. In the process of manufacture, however, they lost their luster, and had to be redipped in liquid tin. Frequently black plates were stamped into shape and then tinned. For some articles, such as ladles, skimmers, etc., black iron sheets were always used, being first stamped into shape and then put through the tinning process.

The firm of E. Ketcham & Co., of Brooklyn, N. Y., began the manufacture of shallow stamped ware in 1857, and in 1862 had 16 tinning pots in its works, and employed a large force of hands twelve months in the year. In addition to the redipping of tin plates which had become oxidized in transit or defaced in the course of manufacture, iron black plates in the form of sheets were also dipped. Occasionally these redipped tin plates or dipped black plates were sold as sheets, but sales of this character were not customary. Usually all tinned black sheets or retinned bright plates were used by the firm in its own works in the manufacture of stamped ware. In no instances were tin plates manufactured for sale on the general market. Black plates were also stamped into various shapes by this

firm, tinned, and then sold. Heavy imported tin plates were used as a rule by all stamping companies, but at times, on account of delay in the arrival of these tin plates, American and foreign black sheets were purchased and tinned.

In addition to the firm of E. Ketcham & Co., the following companies were early engaged in the manufacture of stamped ware, namely: James Aikman & Co., of New York; The Iron Clad Can Company, of New York; F. Haberman, of New York; Sidney Shepard & Co., of Buffalo; the Chicago Stamping Company, of Chicago; the Dover Stamping Company, of Boston; the St. Louis Stamping Company, of St. Louis; John Dunlap, of Pittsburg; and the firm of Lalance & Grosjean, of New York. All these establishments were equipped with tinning pots.

Prior to 1860 the firm of Lalance & Grosjean operated a large number of tinning pots, one of its principal products being tinned iron spoons. This firm also imported and retinned large quantities of French sheet-metal goods, that is, articles which were made from heavy sheet iron and always retinned. It began to manufacture articles of this character about 1862 at its works at Woodhaven, Long Island, N. Y., using a machine devised especially for the purpose. As sheet iron of the necessary strength and ductility could not be procured from the iron manufacturers of the United States, imported black plates were used. These sheets were stamped into the desired shapes, and were dipped in a bath of pure tin. In 1876 the company began to draw the larger part of the black plates it consumed from the United States Iron and Tin Plate Company, of Demmler, Pa. It now manufactures is own black plates. This New York firm was the pioneer in the United States in the manufacture of what was then known as deep French ware, now commonly called deep stamped seamless ware.

Tinned and iron and steel spoons were manufactured from foreign and domestic black plates in large quantities by G. I. Mix & Co., of Yalesville, Conn.; the R. Wallace & Sons Manufacturing Company, of Wallingford, Conn.; and the Oneida Community, also of Wallingford, Conn. Part of the product was also nickel plated after having been coated with tin. At least one of these establishments was engaged in this line of business as early as 1858.

About 1858 or 1859 Mr. John Grey, manager of Hussey's Copper Works, at Pittsburg, Pa., operated tinning pots in that city, black plates being procured from the Sligo Iron Works, of Pittsburg. These plates were pickled and placed in a furnace to remove the loose scales and were then cold rolled and annealed. From these ladles, skimmers, etc., were stamped and subsequently tinned. This business was continued until about 1866. In that year Mr. Grey began the erection of a rolling mill at Pittsburg for the production of black plates, but unexpected difficulties were encountered, and he failed to carry out his enterprise. Mr. Grey produced also tinned copper sheets, the molten tin being put on with a brush on one side of the sheets only. These sheets were largely used in the manufacture of kitchen ware and other household utensils. The careful housewife of the early sixties took especial pride in burnishing the outer side of her copper cooking vessels, all of which, for obvious reasons, were heavily coated with tin on the inner side.

While undoubtedly all of the stamping establishments named above had tinning pots in their plants, they consumed in their own works practically all the plates which they tinned or retinned. As a rule, too, these plants were very heavy purchasers of foreign tin plates, but their consumption of American-made black plates was at no time very large. With the exception of the Philadelphia enterprise mentioned above, the first attempt in the United States to make tin or terne plates for the general market appears to have been in 1872. In the spring of that year a small dipping plant was built in Pittsburg, Pa., near Dinwiddie street and Fifth avenue by four Welshmen, Evan H. Davies, Wm. Oak Davies, John Evans, and Thomas Morgan, who had been employed in tin plate works in their native country. This little plant was put in operation in June, 1872. Both tin plates and terne plates were successfully made and were readily disposed of at good prices. The black plates first used were obtained from the Soho Iron Works, at Pittsburg. They were rolled as sheet iron, sheared to the required size, and pickled in the galvanizing department of the Soho Works. Later plates were obtained from Rogers & Burchfield, at Leechburg, Pa. It was this little dipping plant at Pittsburg which led to the erection of tin plate works at Wellsville, Ohio, and at Demmler, Pa., in 1873, the machinery and tinning pots being removed from Pittsburg to Wellsville in the summer of that year. Evan H. Davies was subsequently connected with the Wellsville plant, and Wm. Oak Davies with the Demmler works.

The pioneer plants for the combined manufacture of black plates and tin and terne plates were established in the United States in 1873 and 1874 by Rogers & Burchfield at Leechburg, Pa., the American Tin Plate Company at Wellsville, Ohio, and the United States Iron and Tin Plate Company at Demmler, Pa.

The rolling mills for the Leechburg enterprise were erected about 1872, or perhaps earlier. It was at these mills in 1874 that natural gas was first used as a fuel in the manufacture of iron. For six months during the year named it was the only fuel used by the firm in its puddling and heating furnaces and for making steam. The tin and terne plate department was added in 1874, and terne plates were first produced in the same year. Tin plates were made in either 1874 or 1875. In the latter year the firm failed, and in May, 1877, the works were sold by the creditors. The purchasers, Kirkpatrick, Beale & Co., produced only terne plates in

their tinning department from 1877 to 1880. In the latter year they were compelled to give up the manufacture of terne plates on account of the low prices then prevailing for imported plates. The rolling-mill department was not closed, however, but continued to run on fine grades of sheet iron and sheet steel suitable for the manufacture of stamped ware. The tin and terne plate department was permanently abandoned in 1880.

In 1873 the American Tin Plate Company completed a rolling mill and a tin and terne plate plant at Wellsville, Ohio, the rolling mill being put in operation in September of that year. The first terne plates were produced in November, 1873, and in the spring of 1874 its first tin plates were turned out. In all, about 530 boxes of 14 by 20 bright plates were produced. The manufacture of both tin and terne plates was discontinued permanently in October, 1874. In 1880 the works were sold to the Wellsville Plate and Sheet Iron Company, which remodeled the plant and began the manufacture of fine grades of plate and sheet iron. It was not until after 1890 that the manufacture of black plates for tinning was resumed. The production of tin and terne plates was never again attempted at this plant.

The United States Iron and Tin Plate Company erected works at Demmler, Pa., in 1873–74, for the manufacture of black plates and tin and terne plates. Terne plates were first made in 1874 and in the following year tin plates were also produced. The black plates consumed in the dipping plant were produced in the rolling mill of the company. In 1877 the coating of iron or steel sheets with tin or with tin and lead was suspended, but black plates were still manufactured for the production of show cards, tea trays, black stamped ware, etc. In 1879 the manufacture of tin and terne plates was resumed, but in 1880 it was again discontinued, the company for a decade thereafter confining its operations to its rolling mill and to the production of specialties in fine sheet iron and sheet steel. In 1890 the manufacture of tin and terne plates was again revived.

Tin plates were produced about 1874 or 1875 by the Iron Clad Can Company at its works at Brooklyn, N. Y. This company, which subsequently changed its name to the Iron Clad Manufacturing Company, consumed in the manufacture of heavy "railroad" milk cans, etc., practically all the tin plates it produced. The black plates used were chiefly from No. 18 to No. 21 gauge in thickness and from 15 by 15 inches to 22 by 42 inches in size, and were obtained from Rogers & Burchfield, of Leechburg, Pa., from the United States Iron and Tin Plate Company, of Demmler, Pa., and later from the Canonsburg Iron and Steel Company, of Canonsburg, Pa. This plant is still engaged in the production of tin plates for its own use.

In 1876 or 1877 the Monitor Tin Plate Company began to manufacture tin plates for sale at its works at Horatio and Water streets, New York city. The black plates used were purchased from P. H. Laufman & Co., of Apollo, Pa., and from the United States Iron and Tin Plate Company, of Demmler, Pa., and varied in thickness from No. 16 to No. 28 gauge and in size from 14 by 50 to 28 by 84 inches. After being tinned they were sold to manufacturers of milk cans, stamped ware, etc. The tinning of black plates was discontinued in 1878 or 1879. The similarity in the names of these two early New York establishments, "Iron Clad" and "Monitor," will not escape notice. Neither of these plants made terne plates, but the Iron Clad Manufacturing Company made at one time stamped iron shingles, and coated them with terne metal.

All the early enterprises named above used charcoal-iron sheets for the manufacture of both tin and terne plates. It was not until about 1876 that steel sheets were experimentally used by the United States Iron and Tin Plate Company, at Demmler, Pa. Some three or four years later establishments in England and Wales began to coat steel sheets with tin, but the honor of the discovery that good tin and terne plates could be made from soft steel sheets undoubtedly belongs to the United States. At the present time very few iron sheets are used in the manufacture of tin or terne plates either in the United States or in foreign countries.

One of the early establishments engaged in the manufacture of black plates for tinning was the firm of P. H. Laufman & Co., which commenced production at Apollo, Pa., in 1878, the plates being sent to New York city, where they were tinned by the Monitor Tin Plate Company. The plant at Apollo produced black plates for tinning for a short time only, the prevailing prices for tin plates being too low to justify the continuance of the New York tin plate enterprise.

In 1887 the Pittsburg Electro Plating Company, of Apollo, Pa., began the manufacture of electroplated steel sheets, coating them with copper, nickel, and other metals, but principally with copper. These sheets were afterwards polished on the electroplated side, and tinned on the other side, the molten tin being put on with a brush. They were used principally in the manufacture of wash boilers and kitchen ware. In 1890 the company began to manufacture terne plates, selling its product in the open market. In the fall of 1892 the plant was moved from Apollo to Butler Junction, Pa., and in 1893 the name of the company was changed to the Laufman Tin Plate Company. Neither of these companies produced tin plates.

Up to the year 1890 the manufacture of tin and terne plates in the United States was carried on under very great difficulties. About 1863 a firm in Pittsburg, Pa., had sent the manager of their copper works to England for the express purpose of learning the tin plate industry. About 1868 an iron company in Johnstown, Pa., also sent an experienced metallurgist and iron-mill worker to Europe for the same purpose. The reports of both gentlemen were unfavorable, each stating that

the industry could not possibly be successfully established in this country under the wage rate then prevailing.

After 1874, however, the Leechburg, Pa., Wellsville, Ohio, and Demmler, Pa., enterprises above mentioned attained considerable success and seriously threatened the monopoly which the English tin-plate manufacturers had so long enjoyed in the United States. To meet this competition, English manufacturers reduced the selling price of their tin and terne plates in this country to such low figures that the manufacture for the general market became unprofitable here and for many years was entirely abandoned. Of the three pioneer black plate and tin and terne plate establishments referred to above, one only, the United States Iron and Tin Plate Company, continued operations under the same management; and this establishment operated its rolling-mill department only, its tin and terne plate department having been closed in 1880. From this year to 1890, very few tin or terne plates were made for sale in the United States.

Tin plates were first produced in Michigan in January, 1889, by the Buhl Stamping Company, of Detroit. Down to the close of the census year this was the only establishment in operation in the state. It consumes its entire output of tin plates in the manufacture of milk-can stock, tubular lanterns, gas meters, etc. This company has never manufactured terne plates.

In 1889 Missouri began to make tin and terne plates for the general market, its first terne plates being produced in April and its first tin plates in September of that year by the St. Louis Stamping Company, of St. Louis. Black plates were obtained from the rolling mill of the company, which was established in 1879, and which had long been engaged in the production of iron sheets suitable for the manufacture of stamped ware.

In the fall of 1889 tin plates were produced in the Western Pennsylvania Exposition Building, at Pittsburg, Pa., by the American Tinned Plate Association. The plant was erected and operated for the purpose of demonstrating that tin plates equal in quality to imported plates could be successfully manufactured in this country. Several hundred boxes of tin plates of fine quality were produced. Terne plates were not made. After running for a short time, the plant was dismantled.

### THE UNITED STATES SINCE 1890, BY STATES.

The great growth in the manufacture of tin and terne plates in the United States has taken place since 1890. The production increased from about 2,236,000 pounds in 1891 to over 849,000,000 pounds in 1900. Indeed, it is possible that the total production of tin and terne plates in this country in the year last named exceeded that of Great Britain. Exact statistics for the United Kingdom are not obtainable, but using the quantity exported as a basis of calculation, and allowing for the ordinary home consumption, it is at least probable that the production of the United States in 1900 exceeded by several thousand tons the total production of Great Britain in that year. The development of the industry in the United States since 1890 will be followed by states.

Early in 1890 both tin and terne plates were made at Demmler, Pa., by the United States Iron and Tin Plate Manufacturing Company. The works were equipped with 6 sets with a weekly capacity of 2,000 boxes, and the company made its own black plates. The plant has since been greatly enlarged. John Hamilton, of Pittsburg, also produced terne plates in April, 1890. His works were equipped with 2 sets and could turn out weekly about 600 boxes of terne plates. Tin plates were not made, and the black plates used were purchased. In June, 1890, the Pittsburg Electro Plating Company, Limited, made terne plates at Apollo, Pa. The works were equipped with 3 sets and had a capacity of about 1,000 boxes weekly. Tin plates were not made, and the black plates used were obtained from the Apollo Sheet Iron Works. All these enterprises were located in the western part of the state. In the eastern part of Pennsylvania, the Penn Treaty Iron Works, of Marshall Bros. & Co., of Philadelphia, began to produce terne plates in January and tin plates in April, 1891. The works had a weekly capacity of 1,000 boxes, and were equipped with 4 sets, 2 of which were used for tin plates and 2 for terne plates. Black plates were also made. In the same year the N. & G. Taylor Company, also of Philadelphia, produced terne plates in April and tin plates in November. Its works were equipped with 3 sets, and 1,150 boxes of tin and terne plates could be produced weekly. Black plates were purchased. Other tin and terne plate enterprises were very shortly established, and Pennsylvania soon became the leading state in the manufacture of tin and terne plates. As shown by the figures for the census year, it still holds this position, its production in the twelve months ending with May 31, 1900, amounting to almost 40 per cent of the total for the United States.

Indiana began to manufacture tin and terne plates in the summer and fall of 1891, works having been erected at Anderson, Madison county, in the spring of that year by the Anderson Tin Plate Company. On July 4 the first box of tin plates was made, and in the following October terne plates also were produced. The works were equipped with 1 set only, tin and terne plates being made alternately. The weekly capacity of the plant was about 400 boxes, and the black plates used were all purchased.

In 1891 the American Tin Plate Company began the erection of a rolling mill and a tin plate plant at Elwood, in Madison county. Black plates were first produced in June, 1892, and in the following month tin and terne plates were also made. The annual capacity of the

rolling mill was about 6,500 gross tons of black plates, all of which were consumed by the company in its tin plate works. The weekly capacity of the tinning department, which was equipped with 10 sets, was 3,500 boxes of tin and terne plates. Natural gas was used for fuel in both the rolling mill and tin dipping works.

In 1892 the Indiana Tin Plate Manufacturing Company began the erection of a plant at Atlanta, in Hamilton county, for the manufacture of both tin and terne plates from purchased black plates. The works were not completed until early in 1893, the first tin plates being made in May and the first terne plates in June of that year. The plant was equipped with 3 sets, 2 of which were used for tin plates and 1 for terne plates. Its weekly capacity was 300 boxes of tin plates and 100 boxes of terne plates. The fuel was natural gas.

In 1893 the Morewood Company erected a rolling mill and tin plate plant at Gas City, in Grant county. Terne plates were made in June of the year named and tin plates in December. The rolling mill was not completed until late in 1893, and black plates were first produced in December of that year. The tinning department was equipped with 10 sets, 8 of which were used for manufacturing tin plates and 2 for terne plates, the latter sets being very large. The weekly capacity of the tinning department was 3,000 boxes of tin plates and 2,000 boxes of terne plates. In the rolling-mill department about 6,200 tons of black plates could be produced annually. Natural gas was used for fuel in all departments.

Early in 1894 the Emlyn Steel and Tin Plate Company began the erection of a black-plate mill and a tin and terne plate plant at Summitville, in Madison county. The buildings were not completed, however, and the enterprise was subsequently abandoned.

In 1893 the Irondale Steel and Iron Company began to erect a rolling mill at Middletown, in Henry county, utilizing machinery brought from its former mill at Anderson, which had been destroyed by fire. The new mill was completed and put in operation in 1894, trains of rolls for the manufacture of black plates being added. Prior to the fire, the works had made a specialty of fine sheet iron. A department for the manufacture of tin and terne plates was added in the fall of 1894, both products being made in November of that year. Eight tinning sets were installed, 7 of which were used for tin plates and 1 for terne plates. The weekly capacity of the tinning department was 4,400 boxes of tin plates and 600 boxes of terne plates. In the rolling mill 10,000 tons of black plates could be produced annually. Natural gas was used for fuel in all departments.

In 1894 the Montpelier Sheet and Tin Plate Company began the erection of a rolling mill and tin plate plant at Montpelier, in Blackford county. The rolling mill was put in operation in May, 1895, and in the following June tin and terne plates were produced. The tinning department was equipped with 12 sets, 11 of which were used for tin plates and 1 for terne plates. The weekly capacity of the plant was about 3,000 boxes of tin plates. In addition, 250 boxes of terne plates, 20 by 28 inches, 216 pounds to the box, could be produced. In the rolling mill about 9,000 gross tons of black plates could be turned out annually. As in the other Indiana tin plate plants, natural gas was used for fuel in all departments.

Late in 1894 the National Tin Plate Company began the erection of a black-plate mill and a tin and terne plate plant at Anderson. Both departments were completed in 1895, black plates and tin and terne plates being first produced in August of that year. The rolling mill had an annual capacity of 13,000 gross tons of black plates, and in the tinning department about 4,000 boxes of tin and terne plates could be produced weekly. Natural gas was the only fuel used in the works.

Although on May 31, 1900, there were only five completed dipping establishments in Indiana, this state ranked second in the quantity and value of tin and terne plates produced during the census year.

After the manufacture of tin and terne plates had been abandoned by the Wellsville enterprise, apparently neither tin nor terne plates were made in commercial quantities in Ohio until 1891. In the summer of that year, the Cincinnati Corrugating Company commenced to manufacture terne plates at Piqua, in Miami county, its first products being turned out on August 16. The works were equipped with 1 tinning set only, and had a weekly capacity of about 250 boxes. The black plates used were obtained from the Piqua Rolling Mill Company. On October 31 of the same year, the Cleveland Tin Plate Company, which had erected works in Cleveland in the summer and fall of 1891, turned out its first tin plates, and on December 14 of the same year its first terne plates were produced. This plant was equipped with 2 sets, 1 for tin plates and 1 for terne plates, its total weekly capacity being about 250 boxes of each product. The black plates used, probably, were obtained from the Britton Rolling Mill Company, of Cleveland, which had erected a plant for their manufacture in 1890–91, and had turned out its first rolled products in May of the latter year. In November, 1891, the firm of W. T. Simpson & Co., of Cincinnati, began the manufacture of terne plates at Riverside, a suburb of Cincinnati. The plant was equipped with 1 set and produced terne plates only, the weekly capacity being about 300 boxes, of 280 pounds each. The black plates used were obtained from the Cincinnati Rolling Mill Company, which a short time previously had equipped its works with hot and cold trains of rolls for the manufacture of plates of this character.

In 1891–2 the firm of Wallace, Banfield & Co., Limited, of Irondale, added 6 tinning pots and 4 automatic tinning machines to its long-established rolling mill. Both tin and terne plates, probably, were produced in

1891, but information regarding the months in which they were made does not seem to be obtainable. The weekly capacity was 2,800 boxes of tin plates and 200 boxes of terne plates. The black plates used were obtained from the rolling mill operated by the firm, the necessary hot and cold trains of rolls having been installed about the time the tinning pots were erected.

Early in 1892 the Record Manufacturing Company, of Conneaut, installed 2 tinning sets and began the manufacture of tin plates. The tinning sets were imported from Wales, workmen from that country having been brought over by the company to start the machines. Tin plates were first made on February 28, 1892. The weekly capacity of the plant was about 480 boxes. Terne plates were not made, and the black plates used were purchased in the open market.

In 1891 the Columbia Tin Plate Company began the erection of a plant at Piqua, Ohio, for the manufacture of tin and terne plates. The works were not completed and the necessary machinery installed, however, until the spring of 1892. In March of that year, tin plates were first made; and in the following June, terne plates also were produced. This plant was equipped with 2 sets, and its weekly capacity was 350 boxes of tin plates and 350 boxes of terne plates. Purchased black plates were used.

Several other establishments for the manufacture of tin and terne plates were erected in Ohio in 1893 and subsequent years. The state ranked third in the manufacture of these articles during the census year.

According to the most reliable information at hand, tin plates were first produced in Illinois in commercial quantities in November, 1890, by Norton Brothers, of Chicago, at their plant at Maywood, in Cook county. Black plates were at first obtained from England and were tinned in Morewood sets, but in November, 1893, American black plates were substituted, and the use of imported black plates was thereafter discontinued. The tin plates made were used by the firm in the manufacture of tin cans. No terne plates were produced.

The second establishment to produce tin plates in Illinois was the Chicago Stamping Company, its first tin plates being turned out in January, 1892. The works of this company were established as early as 1865, its specialty being stamped ware. Tinning pots were erected in 1866 and were used for retinning purposes. Three tinning sets were added in 1891, and tin plates were first regularly produced in 1892. The black plates used were purchased, and terne plates were not made. The weekly capacity of the works was 600 boxes of tin plates, practically all of which were used by the company in its stamping works.

In 1893 the Burn Manufacturing Company erected a tinning set and began the production of tin plates at its works at Chicago Ridge, in Cook county. Purchased black plates were used. The tin plates made were consumed by the company in its stamping works in the manufacture of milk-can stock and other products. The weekly capacity of the plant was about 200 boxes.

During the same year the Chicago Tin Plate Manufacturing Company erected a plant at Wentworth avenue and Fortieth street for the manufacture of both tin and terne plates. Tin plates were first made on September 18, 1893; and ten days later, terne plates also were produced. The plant was equipped with 3 sets, 2 of which were used for the manufacture of tin plates and 1 for terne plates. Its weekly capacity was 700 boxes of 14 by 20 inch tin plates and 400 boxes of 20 by 28 inch terne plates. Black plates were purchased in the general market, but whether of foreign or domestic manufacture we have not been able to ascertain definitely. So far as can be learned, this company was the first to manufacture terne plates in Illinois. It was also the first company in this state to produce either tin or terne plates for sale in the general market, the three establishments previously mentioned having consumed in their own works practically all of the tin plates made.

In October, 1893, the Western Tin Plate Works began to manufacture terne plates at Belleville, in St. Clair county. The works of this company were equipped with 1 set only, and tin plates were never made. The weekly capacity was about 240 boxes of 20 by 28 inch terne plates. Purchased black plates were used.

The first establishment in Illinois to produce both tin and terne plates from black plates made in its own rolling mill was the Great Western Tin Plate Company, of Joliet. The rolling mill had been erected in 1891–92 by the Joliet Sheet Rolling Mill Company for the manufacture of sheet steel, and had turned out its first rolled products in May, 1892. Subsequently it passed into the control of the Great Western Tin Plate Company, and mills for the manufacture of black plates for tinning were installed. In 1895, 6 tinning sets were added, 3 for tin plates and 3 for terne plates, the first products being turned out in March of that year. The weekly capacity of the tinning department was 1,500 boxes of 14 by 20 inch tin plates and 750 boxes of 20 by 28 inch terne plates. The rolling mill could produce annually about 6,000 gross tons of finished black plates.

The only establishment in Missouri for the manufacture of tin and terne plates was that previously referred to, located at St. Louis.

West Virginia did not engage in the manufacture of either tin or terne plates until 1894. In February of that year the Wheeling Corrugating Company began to manufacture terne plates at Wheeling, and in the following month produced tin plates also. The plant was equipped with 4 sets, and about 1,000 boxes of tin or terne plates could be produced weekly on single turn. The black plates used were purchased.

In the summer of 1895 the La Belle Iron Works, of Wheeling, added a tinning plant to their rolling mill. Tin plates were first made in July, 1895, and terne

plates in August. The plant was equipped with 6 sets, 4 of which were used for tin plates and 2 for terne plates, and had a weekly capacity of 2,300 boxes of tin plates and 500 boxes of terne plates. The black plates used were made in the company's rolling mill.

According to the best available information, tin plates were first made in Maryland in April, 1892, by the firm of Mathai Ingram & Co., of Baltimore, manufacturers of stamped ware. All the tin plates produced were consumed by the company in its stamping works. Terne plates were not made, and the black plates used were purchased. The works were equipped with 2 sets, and about 375 boxes of tin plates could be made weekly. On May 11 of the same year, the Locust Point Iron and Steel Works, at Locust Point, in the city of Baltimore, began to manufacture tin plates for the general market. Terne plates also were made, but the exact date when they were first turned out does not seem to be obtainable. The works were equipped with 7 sets. A blackplate mill was connected with this establishment.

In 1892 a plant for the manufacture of tin and terne plates was erected at Canton, in the city of Baltimore, tin plates being made for the first time in January, 1893. The date when terne plates were first made is not known. The plant was equipped with 8 sets, 7 of which were used for tin plates and 1 for terne plates. Its weekly capacity was 3,000 boxes of tin plates and 450 boxes of terne plates. This plant was operated by the Baltimore Iron, Steel, and Tin Plate Company, which soon afterwards acquired the works at Locust Point, and removed the machinery described above from its Canton works to that place. Black plates were obtained from the rolling mill at Locust Point.

In 1895 the Stickney Iron Company erected and put into operation a black plate mill and a tin dipping plant at Canton, in the city of Baltimore. Both tin plates and terne plates were produced. The tinning department was equipped with 4 sets, and had a weekly capacity of 1,500 boxes of tin and terne plates.

In 1896 the Norton Tin Plate and Can Company commenced to manufacture tin plates at Baltimore for the use of its tin can department, its first product being turned out in March. Its works were equipped with 16 sets, and had a weekly capacity of 10,000 boxes. The black plates used were purchased.

Of the 5 Maryland enterprises named above, only 2 were in existence and in operation during the census year, namely, Mathai, Ingram & Co. (operated by the National Enameling and Stamping Company) and the Norton Tin Plate and Can Company. The rolling mills and tin dipping departments of the other plants mentioned were abandoned and dismantled before the opening of the census year. Neither of the 2 plants in Maryland in operation during the census year produced tin plates for the general market, the quantity made being entirely consumed by the companies themselves in the manufacture of their various specialties.

After the Monitor Tin Plate Company gave up the manufacture of tin plates in 1879, no tin-coated sheets were produced in New York state for the general market until 1892, in which year the Somerton Tin Plate Works were started at Brooklyn by Somers Brothers. The plant, which included a rolling mill for the manufacture of black plates, was equipped with 4 tinning sets and had a weekly capacity of 1,800 boxes. No terne plates were produced, and the plant has since been abandoned. During the same year the American Stamping Company, of Brooklyn, produced tin plates, but its entire production was consumed in its own works in the manufacture of stamped ware. It used imported black plates exclusively.

Early in 1891 a plant to manufacture terne plates in commercial quantities for the general market was erected in New York city by the East River Lead Company. This establishment purchased the black plates used and did not make tin plates. The plant has been abandoned.

New York did not produce any black plates for tinning during the census year. In 1891 a rolling mill for their manufacture was erected at Brooklyn by Somers Brothers for the purpose of supplying their tin dipping works with black plates. Black plates were first produced in October, 1892. The rolling mill was dismantled in 1900, having produced its last black plates in 1897.

The only establishment in operation in Michigan during the census year was the Buhl Stamping Company, of Detroit, previously mentioned. Soon after the close of the census year a plant for the manufacture of both tin and terne plates for the general market was completed and put in operation at Muskegon by the Champion Iron and Steel Company. Tin and terne plates were produced in August, 1900, the black plates used being obtained from the company's rolling mill.

Kentucky did not engage in the manufacture of tin and terne plates until 1895, its first tin plates being produced in March and its first terne plates in August of that year by the Licking Rolling Mill Company, at Covington. The tinning department was equipped with 2 sets, 1 for tin plates and 1 for terne plates. Its weekly capacity was about 375 boxes of each product. Black plates were obtained from the rolling mill of the company, which was erected in 1845, the necessary rolls for the manufacture of black sheets having been added in 1894–95. During the census year the company made terne plates only.

The only tin and terne plate plant in Virginia is located at Richmond and is operated by the Old Dominion Iron and Nail Works Company. Tin and terne plates were first produced in November, 1894. The works are equipped with 3 sets, 1 for tin plates and 2 for terne plates. About 350 boxes of tin plates and 700 boxes of terne plates can be produced weekly. The company also operates a rolling mill at Richmond, but it is not

equipped with machinery for the manufacture of black plates, which are therefore purchased from other manufacturers. Terne plates only were made during the census year.

New Jersey did not produce tin or terne plates commercially during the census year, although at one plant, located at Newark, 4 double sets of tinning pots were in operation between June 1, 1899, and May 31, 1900. These were, however, engaged entirely in tinning black stamped ware or in retinning ware stamped from tinned sheets, the company which operated the pots purchasing from other manufacturers the black plates and tinned sheets consumed in its works.

A few years ago New Jersey manufactured small quantities of both tin and terne plates, which were sold in the open market. According to the best information obtainable, it appears that in New Jersey terne plates were first made in October, and tin plates in December, 1892, at Elizabethport, by the Morewood Tin Plate Manufacturing Company. The works were equipped with 8 sets, 6 of which were used for tin plates and 2 for terne plates. The weekly capacity of the plant was 2,400 boxes of tin plates and 2,000 boxes of terne plates. The black plates used were purchased. In November, 1892, the firm of Saunders, Fielding & Bond, of New York city, established a small plant, equipped with 1 set, at Jersey City, N. J., and commenced the manufacture of terne plates. Tin plates were not produced, and the black plates used were purchased. The two enterprises just named are now abandoned.

On December 15, 1898, the American Tin Plate Company was organized, with a capital stock of $50,000,000. This company acquired a large number of completed plants equipped for the manufacture of tin or terne plates or both, as well as for the manufacture of black plates or sheets for tinning. During the census year the company operated 31 tin or terne dipping plants and 34 plants for the manufacture of black sheets. Of the 31 dipping plants 4 produced tin plates only, while at the remaining 27 plants both tin and terne plates were manufactured. The 31 plants of the company had a daily capacity on single turn of 1,527,050 pounds of tin plates and 433,950 pounds of terne plates; on double turn, an annual capacity of 916,230,000 pounds of tin plates and 260,370,000 pounds of terne plates; a total of 1,176,600,000 pounds. The tin dipping works of the company were distributed as follows: Pennsylvania, 15; West Virginia, 1; Ohio, 9; Indiana, 5; and Illinois, 1. As there were 57 tin or terne plate plants in operation during the census year, it will be observed that more than one-half of the active establishments were operated by this company.

## THE PROCESS OF MANUFACTURE.

The following account of the mode of manufacturing tin and terne plates is taken from a lecture on the tin plate industry, delivered by Mr. W. C. Cronemeyer, of Demmler, Pa., before the German Engineers' Society, of Pittsburg, Pa., in the spring of 1899:

When tin plates were first made they were hammered out of blooms, and soon after that came the rolling process. The raw material consisted of either coke or charcoal blooms, which were made in knobbling fires with charcoal or coke as fuel. When charcoal pig iron was used it was generally refined in a run-out fire, and then run in a molten state to the knobbling fire. The blooms made from charcoal pig iron were as a rule used to manufacture tin plates for deep stamping. When the blooms came out of the knobbling fire they were put under a large hammer to further refine them by the hammering process. They were then reheated in a heating furnace and rolled into bars in a bar mill.

When we started to manufacture tin plates in this country in 1873, charcoal only was used in the knobbling fire. For the manufacture of coke plates we used the puddling furnace. As the sheets made from puddled iron did not have a sufficiently smooth surface, we used bars made from hammered charcoal blooms for the top and bottom of the pile. These bars, after being rolled, were cut to lengths of about 27 inches and piled on top of one another, a charcoal bar being put on the top and another on the bottom. The pile was then placed in a heating furnace, hammered once more, and, after reheating, rolled into tin bars. For the cheaper grades of plates this second hammering was omitted, the pile being simply heated and rolled into tin bars direct. All these processes have been done away with by the introduction of soft steel.

The first use of steel for tin plate purposes was made in this country about the year 1876 at the works of the United States Iron and Tin Plate Company, at Demmler, Pa. Capt. William R. Jones was then superintendent of the Edgar Thomson Steel Works. John Cole was superintendent of the United States Works, and I was secretary and business manager of the latter. The two plants being close together we were often with each other, and experiments were made, at the suggestion of Captain Jones, with soft Bessemer steel, which we rolled into shovel steel, etc. Then the idea occurred to us that the same material could be used for tin plates, and after a few experiments it was carried out, Captain Jones having the steel billets made and John Cole superintending the further process of rolling them into bars and then into black plates for tinning. We met with entire success, and found that the percentage of wasters (imperfect plates) in tinning was only about 10 per cent with steel, and even less, while with charcoal iron the wasters generally amounted to 25 per cent. The trade conditions in this country not being at that time ripe for a profitable carrying on of the industry, the use of steel plates for tin or terne plates was not continued here. About three years later, however, in 1879, English manufacturers commenced to use steel instead of iron plates in their tin plate plants. It is an interesting historical fact, and one worthy of preservation, that steel was used in the United States for the manufacture of tin plates at least three years prior to its use for the same purpose by English tin plate manufacturers.

In the manufacture of black plates as now carried on, steel billets are subjected to a welding heat and rolled in grooved rolls into long flat bars, 6, 7, 8, 10, or 12 inches wide, and from three-eighths of an inch to 1 inch thick, according to the required thickness or weight of the finished plates. These bars are cut into shorter pieces (the length of which is about equal to the width of the finished plate), and are heated in furnaces especially constructed for the purpose. The length of the bar becomes the width of the plate, allowing a trifle for scrap. Two of these bars are rolled sidewise, one right after the other, until of the required length, when they are matched and put back into a different furnace from the

one in which they were originally heated. After a second heating they are again rolled, doubled, and put back into the furnace, and, after a third heating, are withdrawn from the furnace, rolled again, and doubled the second time, making eight thicknesses. After a fourth heating the packs are rolled out to the required size. The finished pack is then trimmed, or the rough edges sheared off, and cut into two pieces, 20 by 28 inches, or four pieces, 14 by 20 inches, or, if plates of other dimensions are desired, into sizes that approximate these standards. As there are eight layers in each pack, these layers must be separated. If the packs open well 32 pieces of 14 by 20-inch plates are obtained from the two pieces of bar.

The plates, after being separated, are sent to the pickling room, where they are cleared of the scale formed during heating and rolling. This process consists of immersing the plates in heated diluted sulphuric acid and then cleaning away all traces of the acid by washing the plates in clean water. This is now generally done by the aid of patent pickling machines. The plates are placed in a cradle or receptacle, which, according to the construction of the machine, rises and drops, or revolves, by hydraulic or steam power within a tank, so as to make the liquid rush between the sheets. After being subjected to the action of the acid for some time, the cradle is lifted and dropped into another tank containing an ample supply of clean water only, the cradle being shifted, as in the acid tank, so that the water may rush between the sheets and wash away all traces of the acid. When taken out the plates are bright and clean.

The plates are now ready for the first annealing. For this purpose they are carefully packed on cast or wrought iron "pans" or "stands" having a shallow flange all around, and are covered with cast-iron or wrought-iron covers, known as "annealing boxes" or "pots." The space between the boxes and the flange is filled with sand to exclude the air. The packed "pans" when covered with the annealing boxes are then run into an annealing furnace. Here they are kept at a red heat until the sheets are thoroughly softened. After being taken out the closed boxes are allowed to cool before being unpacked.

The plates are next taken to the "cold-rolling" department. Here they are passed through cold rolls two, three, or more times, as may be deemed necessary, three being the usual number. These rolls are highly polished and are set very accurately in order to give the plates a perfectly flat "set" and a well-polished surface. After this rolling the plates are annealed at a lower temperature than the first time, as the surface of the plates is damaged by the slightest degree of sticking or adhering together.

To finally prepare the plates for tinning they are again pickled and treated as before, except that the liquid is much weaker, after which they are looked over singly, and the unclean spots, if any, scoured with sand and hemp. The plates are then placed in a trough under the surface of clean water to prevent re-oxidation before the "tinman" is ready to dip them.

This is a general outline of the process of manufacture as it has been carried on in Wales for a number of years, and in this country as well. But as soon as the manufacture of tin plates was commenced in the United States, American enterprise and inventive genius took up the matter of introducing improvements so as to reduce the labor involved, cheapen the cost of manufacture, and lessen the consumption of raw materials. So successful has this movement been that the tin plate manufacturing plants of America are, in point of equipment and management, far ahead of those located in England or Wales, where but tardily has any effort been made to increase the efficiency of the tin plate works.

One of the most valuable innovations in tin plate manufacture is the use of electric traveling cranes. Electric cranes are now considered essential parts of all up-to-date tin plate plants. The electric crane is usually of the three-motor type, and spans the hot and cold rolling mills and roll lathe, thus permitting the ready changing of rolls and the carrying of them to and from the lathe in which they are turned. The same crane, or another one, serves to carry the plates from one department to another. This system of crane carriage is very much superior to the old way of wheeling the plates around on hand bogies or otherwise.

The old style of charging the annealing boxes into the furnace was by a hand-charging bogie consisting simply of a long arm running near one end over an axle with a wheel at each end. Beyond this axle were two prongs, which were inserted between the legs of the annealing stand, and a number of men bearing down on the long end served to raise the box and wheeled it into the furnace. These men were busy only when the boxes were being charged or were being withdrawn, and for the balance of the time it was frequently difficult to find suitable employment for them. Now there are a number of efficient machines for charging the boxes, and with any of them the labor is very much reduced. One consists of a long carriage which runs into the furnace on a track. Its top, carrying the boxes, is arranged so that it can be raised or lowered. The boxes are placed on it by a crane, when in a raised position, and in such manner that the flat bottoms of the stands rest on the top of the carriage, while the legs protrude downwards over the side. After running the loaded carriage into the furnace, the top is dropped, so that the boxes are left standing on their legs in the furnace and the bogie is run out from under. Some of these machines are so arranged that the electric crane furnishes the power for moving the bogie; others do this by a separate motor. Another device is a long arm carrying a counterpoise at one end and a box at the other. This is swung by the crane from a point near the middle, and the iron box can thus be run into the furnace and deposited in any position desired.

Another essential improvement has been made in the sheet doubler, or doubling shear. The old Welsh style of running the doubling shear is by a long arm extending underground and connected to the mill shaft, so that the shear makes a stroke for each revolution of the rolls; the speed therefore can not be varied. In the United States the practice is to drive the doubling shears by separate power, either one engine for a line of shears, or, more generally, an engine or electric motor for each shear. The electric motor is well incased, and can be started and stopped with the greatest ease—a very important point, as the doubling shear is not in use all the time that rolling is going on.

In the cold-rolling department some important improvements have also been made. With the old style all the cold mills were arranged in the same line, and the plates, after being fed through the first time, had to be carried around the line to be fed into the second stand, and so on. Now the cold mills are usually arranged "tandem," so that the plates passing through the first stand may be taken on straight to the next. When boys are employed to do this, the mills are frequently arranged so that by turning part way around they can take a bunch of plates which have come from the previous mill and feed them into the next mill without getting up. The latest improvement, however, is to have feed rollers between the mills, so that when the plate is fed into the first stand it is mechanically fed through the other two. There are several devices by which a plate, after it has passed between the first or second pair of rolls, can be thrown out if its edge has been turned or if it has been pinched. Such a plate would seriously injure the surface of the other rolls if it were allowed to pass through them. One of these attachments consists of a lever which a boy throws, the defective plate then passing up and out of the line of feed. The boy's duty is merely to watch the plates as they come out of the first stand of rolls and throw the lever every time a spoiled plate comes along.

Now comes the last process of tinning. The plates are uncoated thus far. After the second annealing and second pickling, as heretofore described, they are taken to the tin house in troughs mounted on wheels and filled with clean water. There are two tinning processes, the so-called "acid" process and the "palm-oil" process. The latter is the older and is not so much used now as the former. By the oil process a batch of plates is boiled in palm oil for about twenty minutes, thus evaporating the water and any acid which

could possibly adhere to the plates. The sheets are next passed to another pot, containing molten tin or terne, the latter being the name given to the mixture of tin and lead. There is oil floating on the top of this molten metal. After being dipped in this metal the sheets are taken to the second pot of metal, where they are allowed to soak for some time. From this pot they are taken by the tinman, who lays them on the "hob," a space between the second and third metal pots, which is covered with iron plates. Here they are brushed thoroughly with hemp on each side to remove any oxide or dross which might adhere. The plates then go to the third metal pot, which contains metal of extra purity. After being dipped in this pot they are taken to a pot containing rolls running in oil, by which the surface is smoothed and by the aid of which the amount of coating can be regulated. In the other tinning process the flux used is muriate of zinc, which is so energetic in its action that it is only necessary to have a thin layer of it floating on the surface of the single bath of molten tin. The plates are passed down through this flux into the tin and come out of the tin at another place in the pot, where the surface is covered with oil. Rolls and guides are used in the tin and in the oil to convey the plates. The rolls through which the plates pass are of very correct shape, and must be carefully adjusted to regulate the amount of coating on the plates. To produce an extra good quality of roofing plates, the best plates are selected from those previously coated by the first described palm-oil process, and redipped successively in other receptacles containing molten metal and palm oil, without the use of rolls, and in such a manner as to cause a much larger quantity of coating to adhere to the surface. The coating can be regulated by the speed with which the plates are drawn out after immersion in the metal pot; also by the length of time they remain in the oil pot. When the plates come out of the last bath a coating of oil adheres to them. This is removed by passing them through bran or middlings, and then polishing them with sheepskin. The old English method of doing this work by hand has been almost entirely supplanted in the United States by branning and polishing or dusting machines.

In the tin house it is a common practice now to drive all the machinery by electric motors. As each one of these machines requires but a small power, and as it is desirable to arrange them independently of the requirements of shafting, belts, etc., the advantage of electric driving, with a separate motor for each machine or line of machines, is very apparent. Electric motors are commonly used for driving the tinning machines, branning machines, dusters, and slitting shears, the last named being located in the assorting room, away from the dust of the tin house.

Concerning the use of the terms "coke" and "charcoal" as applied to tin and terne plates, Mr. Cronemeyer says that they are now misnomers and that they refer at the present time "only to the thickness of the tin coating, a 'coke' plate having on it the lightest coating of tin, while a 'charcoal' plate has a heavier coating. Both may be made from identically the same black plate. The use of these terms originated when charcoal iron and coke iron were both used in tin plate making. Charcoal iron, being of better quality, was given a heavier coating of tin, while coke iron was used only for the cheaper grades, which were given a lighter coating. When steel came to be universally used the terms remained, referring then only to the quantity of the coating." In the present nomenclature an additional distinction is made between plates made of Bessemer, and open-hearth or Siemens steel, so that the terms now used are Bessemer charcoal and Bessemer coke plates, as well as open-hearth charcoal and open-hearth coke plates.

## PRODUCTION AND CONSUMPTION OF PIG TIN.

Pig tin has not been produced in the United States since the calendar year 1893, in which year 8,938 pounds were smelted, valued at $1,788, as compared with 162,000 pounds in 1892, valued at $32,400, and 125,289 pounds in 1891, valued at $25,058. Almost all of this tin was produced at the Temescal mines in San Bernardino county, Cal. Prior to 1891 statistics of the production of pig tin in this country do not appear to have been collected, although, according to a correspondent of the London Financial News for March 27, 1890, pig tin was produced commercially at the Temescal (or San Jacinto) tin mines in California as early as 1869, the quantity smelted being "50 bars, weighing 100 pounds each," or about 5,000 pounds in all. One of these bars is probably the one now on exhibition at the Smithsonian Institution, at Washington, D. C. It weighs 70 pounds, and the inscription, which is dated March, 1870, states that it is made from tin ore obtained from the mines of the San Jacinto (Tin) Company, of California. Its number is 16,096. A small ingot of tin smelted in 1840 from ore found at Jackson, N. H., is also exhibited by this institution. The correspondent mentioned above also says that sheets of American iron coated with Temescal or San Jacinto tin, some of which were manufactured into various articles of domestic use, were placed on exhibition at the Seventh Industrial Fair, held at San Francisco, Cal., in 1870. He adds that boxes of tin plates, bars of pig tin, etc., were also exhibited, and were awarded a gold medal (first prize). This statement is doubtless correct, for among the collection of tinned sheets at the Smithsonian Institution is specimen No. 16,095, which is evidently a piece of the American sheet iron mentioned by the correspondent. The inscription states that it is coated with tin from the San Jacinto mines.

The United States is now entirely dependent upon other countries for the pig tin used in coating the tin and terne plates it produces. Its chief source of supply is the East Indies, whence it imported in the calendar year 1900, 32,984,136 pounds, valued at $9,090,611; in 1899, 47,905,836 pounds, valued at $10,819,391; and in 1898, 43,376,454 pounds, valued at $5,934,945. From the United Kingdom, which sends to the United States annually large quantities of pig tin, 30,954,341 pounds, valued at $8,891,682, were imported in 1900; 18,962,290 pounds, valued at $4,801,607, in 1899; and 15,362,383 pounds, valued at $2,247,348, in 1898. Between 4,000,000 and 5,000,000 pounds of pig tin are

also imported annually from the Netherlands and other countries.

During the calendar year 1900 the total imports of tin into the United States in bars, blocks, pigs, etc., were 69,068,568 pounds, valued at $19,458,586; in 1899 they were 71,248,407 pounds, valued at $16,746,105; and in 1898, 62,748,399 pounds, valued at $8,770,221. The average value of this tin at the foreign port of shipment was over 28 cents per pound in 1900 and over 23.5 cents per pound in 1899. In 1898, however, it was a little less than 14 cents per pound, the increase in price in 1900 as compared with 1898 amounting to over 100 per cent.

The world's production of pig tin has largely increased in late years, especially since the development of the tin plate industry in the United States. In 1884, according to the best available statistics, the world's production amounted to 50,299 metric tons of 2,204 pounds. In 1890 the production had increased to 61,538 tons, in 1891 to 65,062 tons, in 1892 to 69,560 tons, in 1893 to 74,658 tons, in 1894 to 83,387 tons, and in 1895 to 83,425 tons. In 1896 it fell to about 83,250 tons, in 1897 to about 75,400 tons, and in 1898 to about 75,200 tons. In 1899 it increased to about 78,850 tons, and in 1900 to approximately 80,000 tons.

Reducing to gross tons the imports of pig tin into the United States in 1900, 1899, and 1898, and assuming that the entire quantity was consumed within its boundaries, which is practically the case, it will be found that in 1900 this country consumed 30,834 tons of pig tin; in 1899, 31,807 tons; and in 1898, 28,013 tons; in each case more than three-eighths of the world's total production for the year. During the decade from 1880 to 1890, however, and before the establishment of a tin plate industry in this country, the imports of pig tin amounted on an average to about 12,215 gross tons, the total quantity imported in the fiscal year 1884 being 11,621 gross tons, or less than one-fourth of the world's production in that year. A large part of the pig tin imported prior to 1890 was consumed by the stamping companies of the United States in the production of their various specialties.

## ACKNOWLEDGMENTS.

The writer desires to express his sincere thanks to the gentlemen and organizations named below for aid rendered him in the preparation of the foregoing report. It is not possible to mention all who have assisted in its preparation, but those named are entitled to special recognition. W. G. G.

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Mr. John Jarrett, Pittsburg, Pa.
Mr. George W. Ketcham, vice-president Central Stamping Company, New York City, N. Y.
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Mr. Persifor F. Smith, Pittsburg, Pa.
N. & G. Taylor Company, Philadelphia, Pa.
The American Iron and Steel Association, Philadelphia, Pa.
Smithsonian Institution, Washington, D. C.

TABLE 21.—THE TIN AND TERNE DIPPING INDUSTRY: BY STATES, 1900.

| | United States. | Illinois. | New York | Ohio. | Pennsylvania. | All other states.[1] |
|---|---|---|---|---|---|---|
| Number of establishments | 57 | 3 | 4 | 12 | 25 | 13 |
| Character of organization: | | | | | | |
| Individual | 2 | 1 | | | 1 | |
| Firm and limited partnership | 5 | | 1 | | 4 | |
| Incorporated company | 50 | 2 | 3 | 12 | 20 | 13 |
| Capital: | | | | | | |
| Aggregate | $6,790,047 | $413,055 | $245,579 | $1,203,265 | $3,042,029 | $1,886,119 |
| Direct investment, total | $6,650,047 | $413,055 | $245,579 | $1,153,265 | $3,027,029 | $1,811,119 |
| Land | $429,400 | $32,000 | $20,100 | $53,300 | $233,500 | $90,500 |
| Buildings | $619,685 | $36,000 | $44,300 | $101,335 | $267,947 | $170,103 |
| Machinery, tools, and implements | $1,973,355 | $158,000 | $35,179 | $405,327 | $915,349 | $459,500 |
| Cash and sundries | $3,627,607 | $187,055 | $146,000 | $593,303 | $1,610,233 | $1,091,016 |
| Value of rented property | $140,000 | | | $50,000 | $15,000 | $75,000 |
| Proprietors and firm members | 15 | 1 | 2 | 1 | 11 | |
| Salaried officials, clerks, etc.: | | | | | | |
| Total number | 333 | 16 | 23 | 38 | 189 | 67 |
| Total salaries | $291,323 | $19,323 | $28,430 | $33,301 | $147,202 | $68,067 |
| Officers of corporations— | | | | | | |
| Number | 28 | 1 | 1 | 4 | 14 | 8 |
| Salaries | $73,221 | $2,500 | $1,500 | $8,400 | $36,221 | $24,600 |
| General superintendents, managers, clerks, etc.— | | | | | | |
| Total number | 305 | 15 | 22 | 34 | 175 | 59 |
| Total salaries | $218,102 | $16,823 | $21,930 | $24,901 | $110,981 | $43,467 |
| Men— | | | | | | |
| Number | 281 | 13 | 21 | 33 | 158 | 56 |
| Salaries | $209,528 | $15,573 | $21,280 | $24,601 | $105,487 | $42,587 |
| Women— | | | | | | |
| Number | 24 | 2 | 1 | 1 | 17 | 3 |
| Salaries | $8,574 | $1,250 | $650 | $300 | $5,494 | $880 |
| Wage-earners, including pieceworkers, and total wages: | | | | | | |
| Greatest number employed at any one time during the year | 5,326 | 224 | 76 | 1,031 | 2,363 | 1,632 |
| Least number employed at any one time during the year | 3,433 | 117 | 58 | 686 | 1,665 | 907 |
| Average number | 3,671 | 166 | 55 | 697 | 1,678 | 1,175 |
| Wages | $1,889,917 | $88,061 | $25,399 | $394,676 | $813,692 | $568,089 |
| Men, 16 years and over— | | | | | | |
| Average number | 3,014 | 151 | 55 | 564 | 1,284 | 960 |
| Wages | $1,711,475 | $83,943 | $25,399 | $353,649 | $736,818 | $511,666 |
| Women, 16 years and over— | | | | | | |
| Average number | 625 | 15 | | 133 | 288 | 189 |
| Wages | $172,568 | $4,118 | | $41,027 | $75,760 | $51,663 |
| Children, under 16 years— | | | | | | |
| Average number | 32 | | | | 6 | 26 |
| Wages | $5,874 | | | | $1,114 | $4,760 |
| Average number of wage-earners, including pieceworkers, employed during each month: | | | | | | |
| Men, 16 years and over— | | | | | | |
| January | 3,168 | 66 | 64 | 682 | 1,305 | 1,051 |
| February | 3,371 | 144 | 72 | 697 | 1,416 | 1,042 |
| March | 3,300 | 170 | 78 | 652 | 1,341 | 1,064 |
| April | 3,433 | 182 | 75 | 697 | 1,545 | 934 |
| May | 3,534 | 187 | 76 | 646 | 1,545 | 1,080 |
| June | 3,303 | 145 | 59 | 644 | 1,365 | 1,090 |
| July | 2,187 | 134 | 20 | 443 | 888 | 702 |
| August | 3,061 | 185 | 20 | 644 | 1,233 | 979 |
| September | 3,273 | 183 | 51 | 534 | 1,495 | 1,010 |
| October | 2,861 | 170 | 47 | 476 | 1,332 | 836 |
| November | 2,683 | 147 | 54 | 412 | 1,173 | 897 |
| December | 1,940 | 97 | 54 | 245 | 769 | 775 |
| Women, 16 years and over— | | | | | | |
| January | 623 | 10 | | 148 | 262 | 203 |
| February | 690 | 18 | | 178 | 291 | 203 |
| March | 693 | 20 | | 178 | 292 | 203 |
| April | 705 | 20 | | 178 | 306 | 201 |
| May | 672 | 20 | | 148 | 303 | 201 |
| June | 659 | 16 | | 145 | 297 | 201 |
| July | 457 | 6 | | 118 | 244 | 89 |
| August | 642 | 12 | | 145 | 285 | 200 |
| September | 686 | 14 | | 127 | 344 | 201 |
| October | 619 | 16 | | 100 | 315 | 188 |
| November | 619 | 18 | | 82 | 318 | 201 |
| December | 481 | 10 | | 49 | 196 | 174 |
| Children, under 16 years— | | | | | | |
| January | 30 | | | | 7 | 23 |
| February | 30 | | | | 6 | 24 |
| March | 31 | | | | 9 | 22 |
| April | 31 | | | | 7 | 24 |
| May | 28 | | | | 5 | 23 |
| June | 36 | | | | 5 | 31 |
| July | 42 | | | | 7 | 35 |
| August | 42 | | | | 5 | 37 |
| September | 44 | | | | 6 | 38 |
| October | 27 | | | | 6 | 21 |
| November | 23 | | | | 4 | 19 |
| December | 23 | | | | 3 | 20 |
| Miscellaneous expenses: | | | | | | |
| Total | $236,456 | $29,993 | $14,058 | $38,963 | $82,169 | $71,273 |
| Rent of works | $6,495 | | | $1,800 | $1,175 | $3,520 |
| Taxes, not including internal revenue | $27,776 | $1,719 | $1,161 | $3,631 | $11,202 | $10,063 |
| Rent of offices, insurance, interest, and all sundry expenses not hitherto included | $202,185 | $28,274 | $12,897 | $33,532 | $69,792 | $57,690 |
| Materials used: | | | | | | |
| Total cost | $26,728,150 | $1,778,048 | $366,409 | $5,012,175 | $10,364,084 | $9,207,434 |
| Black plates or sheets for tinning— | | | | | | |
| Domestic— | | | | | | |
| Pounds | 325,556,992 | 47,221,710 | 9,203,923 | 157,575,523 | 321,828,795 | 289,727,041 |
| Cost | $20,590,566 | $1,367,602 | $278,718 | $3,826,777 | $7,810,211 | $7,307,258 |
| Foreign— | | | | | | |
| Pounds | 2,358,607 | | | | 2,156,607 | 202,000 |
| Cost | $78,282 | | | | $71,128 | $7,154 |
| Pig tin— | | | | | | |
| Pounds | 20,282,778 | 1,286,678 | 224,766 | 3,954,389 | 8,154,969 | 6,661,976 |
| Cost | $4,528,473 | $361,153 | $62,850 | $826,969 | $1,797,220 | $1,480,281 |
| Pig lead— | | | | | | |
| Pounds | 6,871,480 | 25,038 | 164,800 | 1,678,566 | 4,003,431 | 999,645 |
| Cost | $393,617 | $3,858 | $6,592 | $108,095 | $228,312 | $51,760 |

[1] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; Virginia, 1; West Virginia, 2.

TABLE 21.—THE TIN AND TERNE DIPPING INDUSTRY: BY STATES, 1900—Continued.

| | United States. | Illinois. | New York. | Ohio. | Pennsylvania. | All other states.[1] |
|---|---|---|---|---|---|---|
| Material used—Continued. | | | | | | |
| Total cost—Continued. | | | | | | |
| Palm oil— | | | | | | |
| Pounds | 5,511,645 | 198,046 | 45,390 | 1,309,820 | 2,572,428 | 1,385,961 |
| Cost | $282,227 | $10,439 | $2,837 | $64,492 | $133,672 | $70,787 |
| Sulphuric acid, tinning flux, bran, and pink meal | $187,318 | $18,642 | $2,255 | $30,013 | $86,703 | $49,705 |
| Boxes and nails | $303,316 | $300 | $2,200 | $70,568 | $145,742 | $84,206 |
| Fuel: | | | | | | |
| Anthracite coal and culm— | | | | | | |
| Tons | 4,456 | ..... | 180 | ..... | 4,276 | ..... |
| Cost | $6,465 | ..... | $880 | ..... | $5,585 | ..... |
| Bituminous coal and slack— | | | | | | |
| Tons | 35,048 | 5,661 | 501 | 7,829 | 11,820 | 9,237 |
| Cost | $48,059 | $8,231 | $1,525 | $7,352 | $16,038 | $14,913 |
| Coke— | | | | | | |
| Tons | 975 | ..... | ..... | ..... | 25 | 950 |
| Cost | $2,000 | ..... | ..... | ..... | $100 | $1,900 |
| Charcoal— | | | | | | |
| Bushels | 556 | ..... | 300 | ..... | ..... | 256 |
| Cost | $122 | ..... | $70 | ..... | ..... | $52 |
| Natural gas | $34,110 | ..... | ..... | $7,037 | $18,778 | $8,295 |
| Oil | $700 | $700 | ..... | ..... | ..... | ..... |
| Rent of power and heat | $2,000 | ..... | ..... | ..... | ..... | $2,000 |
| Mill supplies | $49,198 | $6,105 | $595 | $7,143 | $26,758 | $8,597 |
| All other materials | $164,345 | $718 | $1,081 | $61,927 | $5,518 | $95,101 |
| Freight | $52,352 | ..... | $6,806 | $1,802 | $18,319 | $26,425 |
| Products: | | | | | | |
| Total value | $31,892,011 | $2,081,837 | $463,199 | $6,023,314 | $12,530,991 | $10,792,670 |
| Tin plates— | | | | | | |
| Pounds | 707,718,239 | 47,296,727 | 5,591,050 | 182,163,383 | 256,879,332 | 265,787,747 |
| Value | $25,553,021 | $1,999,489 | $258,199 | $4,623,930 | $9,137,483 | $9,533,920 |
| Terne plates— | | | | | | |
| Pounds | 141,285,783 | ..... | 3,900,000 | 30,146,921 | 77,129,648 | 30,109,214 |
| Value | $5,731,124 | ..... | $205,000 | $1,176,773 | $3,263,769 | $1,085,582 |
| Other sheet iron or sheet steel, tinned or terne plated— | | | | | | |
| Pounds | 1,000,473 | 800,000 | ..... | ..... | 200,473 | ..... |
| Value | $86,492 | $80,000 | ..... | ..... | $6,492 | ..... |
| All other products | $181,674 | $2,348 | ..... | $204,611 | $123,247 | $151,468 |
| Custom work and repairing | $39,700 | ..... | ..... | $18,000 | ..... | $21,700 |
| Tin and terne plates exported during the year: | | | | | | |
| Pounds | 17,939 | ..... | ..... | ..... | 17,939 | ..... |
| Value | $897 | ..... | ..... | ..... | $897 | ..... |
| Daily capacity of plant—single turn: | | | | | | |
| Total | 2,782,901 | 142,000 | 47,800 | 495,500 | 1,198,001 | 849,600 |
| Tin plates, pounds | 2,003,588 | 142,000 | 27,800 | 358,500 | 791,888 | 683,350 |
| Terne plates, pounds | 729,363 | ..... | 20,000 | 137,000 | 406,113 | 166,250 |
| Comparison of products: | | | | | | |
| Number of establishments reporting for both years | 20 | 1 | 3 | 2 | 8 | 6 |
| Value for census year | $6,146,455 | $1,395,387 | $404,699 | $249,004 | $2,250,978 | $1,846,392 |
| Value for preceding business year | $4,014,362 | $646,117 | $288,401 | $152,045 | $1,704,592 | $1,223,207 |
| Power: | | | | | | |
| Number of establishments reporting | 56 | 3 | 4 | 12 | 24 | 13 |
| Total horsepower, owned | 3,913 | 480 | 152 | 612 | 1,620 | 1,049 |
| Engines, steam— | | | | | | |
| Number | 71 | 4 | 4 | 17 | 29 | 17 |
| Horsepower | 3,505 | 380 | 140 | 580 | 1,416 | 989 |
| Electric motors— | | | | | | |
| Number | 16 | 2 | 1 | 1 | 10 | 2 |
| Horsepower | 398 | 100 | 12 | 32 | 194 | 60 |
| Other power— | | | | | | |
| Number | 1 | ..... | ..... | ..... | 1 | ..... |
| Horsepower | 10 | ..... | ..... | ..... | 10 | ..... |
| Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | | |
| Total number of establishments | 57 | 3 | 4 | 12 | 25 | 13 |
| 5 to 20 | 6 | ..... | 3 | 1 | 1 | 1 |
| 21 to 50 | 9 | 1 | ..... | 1 | 6 | 1 |
| 51 to 100 | 20 | 1 | 1 | 7 | 7 | 4 |
| 101 to 250 | 19 | 1 | ..... | 3 | 9 | 6 |
| 251 to 500 | 3 | ..... | ..... | ..... | 2 | 1 |

[1] Includes establishments distributed as follows: Indiana, 5, all controlled by one company; Kentucky, 1; Maryland, 2; Michigan, 1; Missouri, 1; Virginia, 1; West Virginia, 2.

TABLE 22.—THE TIN AND TERNE DIPPING INDUSTRY: IDLE AND BUILDING ESTABLISHMENTS, BY STATES, 1900.

| | IDLE ESTABLISHMENTS. | | | BUILDING ESTABLISHMENTS. | | |
|---|---|---|---|---|---|---|
| | United States. | Ohio. | Pennsylvania. | United States. | Michigan. | Pennsylvania. |
| Number of establishments | 2 | 1 | 1 | 2 | 1 | 1 |
| Character of organization: | | | | | | |
| Incorporated company | 2 | 1 | 1 | 2 | 1 | 1 |
| Capital: | | | | | | |
| Total | $27,225 | $2,225 | $25,000 | $580,259 | $529,259 | $51,000 |
| Land | $10,725 | $725 | $10,000 | $30,000 | $20,000 | $10,000 |
| Buildings | $10,500 | $500 | $10,000 | $40,000 | $20,000 | $20,000 |
| Machinery, tools, and implements | $6,000 | $1,000 | $5,000 | $322,250 | $317,250 | $5,000 |
| Cash and sundries | ..... | ..... | ..... | $188,009 | $172,009 | $16,000 |
| Daily capacity of plant—single turn: | | | | | | |
| Tin plates, pounds | 15,000 | ..... | 15,000 | ..... | ..... | ..... |
| Terne plates, pounds | 12,000 | 5,000 | 7,000 | ..... | ..... | ..... |
| Power: | | | | | | |
| Number of establishments reporting | 2 | 1 | 1 | ..... | ..... | ..... |
| Total horsepower, owned | 840 | 800 | 40 | ..... | ..... | ..... |
| Engines, steam— | | | | | | |
| Number | 13 | 12 | 1 | ..... | ..... | ..... |
| Horsepower | 840 | 800 | 40 | ..... | ..... | ..... |

# LEAD, COPPER, AND ZINC, SMELTING AND REFINING.

# LEAD, COPPER, AND ZINC, SMELTING AND REFINING.

By CHARLES KIRCHHOFF, *Expert Special Agent.*

In the earlier stages of the development of our resources of the base and precious metals, particularly in the Rocky Mountain region, the absence of railroads and the high cost of transportation made local metallurgical treatment a necessity. The mining of ores and the subsequent working of them were frequently carried on by the same individual, firm, or corporation, and it was difficult to ascertain the amount of capital invested in each, or make a division of the aggregate labor of the establishment between the two processes, or estimate the value of the ore when charged into the smelter. These difficulties appear to have resulted in combining the statistics for mining and the milling and smelting and refining of ores at all prior censuses except that for 1870. At the census of 1870 a separation was made of the mining and manufacturing, and the treatment of the ores after their delivery from the mines was classed as manufacturing. The statistics for the two branches of the industry are again separated at the census of 1900, and those for the smelting of ores and the refining and separation of the metals are included in the report on the manufactures. The statistics for mines, mining, and ore dressing will be presented in subsequent reports, to be published in conformity with section 8 of the act of Congress of March 3, 1899, providing for taking the Twelfth and subsequent censuses.

The crushing and milling of quartz, the separation of gold and silver from the ore in concentrating and separating plants, operated either under the cyanide process or other methods, are so closely allied with the mining industry that the statistics will constitute a part of the report on mines and mining, and will not be included in the report on manufactures. With the exception of the extraction of iron from iron ore in blast furnaces, which will be treated in the special report on iron and steel, the statistics presented herewith include all the data collected by the Twelfth Census regarding the smelting of ores and refining of the crude metals or metal alloys obtained in smelting.

Copper and lead ores frequently contain paying quantities of gold and silver, and a large tonnage of the "dry ores" of gold and silver free from base metals is smelted with the lead and copper ores to facilitate the extraction of the metals. In these cases the base metals are merely the carriers for the precious metals. The reports for a number of the smelters and refiners show that the value of the precious metals exceeded the value of the base metals, while other reports show that the smelting of lead is only incidental to the extraction of the precious metals and the subsequent parting operation. If the principle were followed of classifying schedules according to the product of chief value, a number of those included in this report would be classified as refineries of gold and silver. This report, however, includes the returns from all establishments in which copper or lead ore was smelted or refined, irrespective of the value of these baser metals as compared with the value of the other products of the establishment. From the reports of the copper and lead smelters and refiners presented herewith, it appears that they produced 83,650,828 fine ounces of silver and 2,739,188 fine ounces of gold during the calendar year 1899. According to the report of the director of the mint, there were 54,764,500 ounces of silver and 3,437,210 ounces of gold produced during the calendar year 1899; but this does not include the product of the foreign ores and furnace materials treated in bond, and, on the other hand, the gold reported by the smelters does not include the products of placer mining or products that do not pass through the smelter, but which are included in the report of the director of the mint. Thus the amounts reported by the director of the mint are not comparable with those shown in this report.

Smelting and refining being reported as an adjunct to the mining industry at the census of 1890, no attempt

was made to secure data which would be in harmony with the returns obtained for manufacturing industries, and it is therefore impossible to present comparable statistics for all the items reported for 1900.

If the three branches of the industry are ranked according to the value of their products, including the precious metals, lead stands first, copper second, and zinc third. The reports for each industry relate to the calendar year 1899, although in isolated instances the returns from individual producers were given for their fiscal years.

Table 1 is a consolidated summary of the totals for the 3 industries, lead, copper, and zinc, smelting and refining.

TABLE 1.—SUMMARY FOR THE UNITED STATES OF THE LEAD, COPPER, AND ZINC SMELTING INDUSTRIES: 1900.[1]

| | Total. | Lead. | Copper. | Zinc. |
|---|---|---|---|---|
| Number of establishments | 117 | 39 | 47 | 31 |
| Capital | $139,354,138 | $72,148,923 | $53,063,395 | $14,141,810 |
| Land | $8,039,843 | $3,704,552 | $2,091,415 | $2,243,876 |
| Buildings | $43,116,399 | $21,974,850 | $15,670,959 | $5,470,590 |
| Machinery, tools, and implements | $34,187,168 | $26,480,025 | $5,771,389 | $1,935,754 |
| Cash and sundries | $54,010,728 | $19,989,506 | $29,529,632 | $4,491,590 |
| Salaried officials, clerks, etc., number | 1,121 | 425 | 488 | 208 |
| Salaries | $2,150,018 | $754,913 | $954,905 | $440,200 |
| Wage-earners, average number | 24,512 | 8,319 | 11,324 | 4,869 |
| Total wages | $15,973,626 | $5,088,684 | $8,529,021 | $2,355,921 |
| Miscellaneous expenses | $3,088,007 | $1,166,210 | $1,522,325 | $399,472 |
| Cost of materials used | $279,655,350 | $144,195,163 | $122,174,129 | $13,286,058 |
| Value of products | $358,786,472 | $175,466,304 | $165,131,670 | $18,188,498 |

[1] This report is for the calendar year 1899.

# LEAD, SMELTING AND REFINING.

Table 2 shows the totals for the establishments reported at the Twelfth Census as engaged in the smelting and refining of lead.

TABLE 2.—LEAD, SMELTING AND REFINING: SUMMARY FOR THE UNITED STATES, 1900.[1]

| | United States. | Colorado. | Missouri. | Montana. | All other states and territories.[2] |
|---|---|---|---|---|---|
| Number of establishments | 39 | 8 | 11 | 3 | 17 |
| Capital | $72,148,993 | $22,569,715 | $944,539 | $2,858,158 | $45,776,521 |
| Land | $3,704,552 | $1,057,264 | $107,000 | $63,334 | $2,476,954 |
| Buildings | $21,974,850 | $7,064,040 | $269,550 | $939,953 | $13,701,307 |
| Machinery, tools, and implements | $26,480,025 | $8,752,414 | $61,128 | $1,191,663 | $16,474,820 |
| Cash and sundries | $19,989,566 | $5,695,997 | $506,861 | $663,208 | $13,123,440 |
| Salaried officials, clerks, etc., number | 425 | 137 | 35 | 27 | 226 |
| Salaries | $754,913 | $288,119 | $47,360 | $73,818 | $345,616 |
| Wage-earners, average number | 8,319 | 3,316 | 474 | 563 | 3,966 |
| Total wages | $5,088,684 | $2,890,383 | $255,590 | $397,771 | $2,044,940 |
| Miscellaneous expenses | $1,166,210 | $154,061 | $41,565 | $47,626 | $923,018 |
| Cost of materials used[3] | $144,195,163 | $33,996,975 | $3,317,558 | $4,835,771 | $102,044,859 |
| Value of products[3] | $175,466,304 | $40,782,271 | $3,852,435 | $5,264,253 | $125,617,345 |

[1] This report is for the calendar year 1899.
[2] Includes establishments distributed as follows: California, 1; Idaho, 1; Illinois, 2; Iowa, 1; Kansas, 2; Nebraska, 1; New Jersey, 2; New Mexico, 1; Texas, 1; Utah, 2; Virginia, 1; Washington, 2.
[3] The difference between the cost of materials and value of product, as shown in Tables 1 and 2 and in Table 13, is caused by the duplication in the latter table of the intermediate product between the ore and the refined metal, amounting to $25,508,208 in the United States—$9,204,735 in Colorado and $16,303,468 in all other states.

In addition to the 39 active establishments shown in Table 2, there were 3 idle establishments with a capital of $629,871: 1 located in Missouri, 1 in Nevada, and 1 in Utah.

The primary object of the statistics for the industry, as compiled at the census of 1890 and published in the Report on Mineral Industries, was to show the total quantity of lead produced. They do not show the number of establishments or capital engaged in the industry or the total value of the products; and the statistics concerning employees, salaries, wages, and expenses were not compiled in conformity with the methods followed in compiling the statistics for manufactures, and therefore can not be used for purposes of comparison. Table 3 shows the totals for the lead smelting and refining works as reported at the census of 1890.

TABLE 3.—LEAD, SMELTING AND REFINING: 1889.[1]

| | | | |
|---|---|---|---|
| Expenditures, total | $11,457,367 | Average days employed: | |
| Wages | $4,228,634 | Foremen | 337 |
| Salaries | $510,716 | Mechanics | 322 |
| Supplies and materials | $5,154,682 | Laborers | 307 |
| Rent, insurance, taxes, etc. | $1,489,715 | Boys | 336 |
| Contractors | $73,620 | Products: | |
| Number of employees: | | Refined lead (short tons) | 182,967 |
| Office force | 249 | Fine copper in matte (pounds) | 4,195,929 |
| Foremen | 173 | Stock: | |
| Mechanics | 354 | Base bullion (short tons), January 1, 1889 | 1,474 |
| Laborers | 5,595 | Base bullion (short tons), January 1, 1890 | 4,780 |
| Boys | 9 | Refined lead (short tons), January 1, 1889 | 12,058 |
| Average daily wages: | | Refined lead (short tons), January 1, 1890 | 9,230 |
| Foremen | $3.98 | | |
| Mechanics | $2.93 | | |
| Laborers | $2.15 | | |
| Boys | $0.50 | | |

[1] Mineral Industries in the United States, Eleventh Census, Lead and Zinc, page 172.

The industry has made great progress during the past decade, and the methods of manufacture and management have changed so materially that the quantity of the product is the most reliable indication of the extent of the increase. The lead product for 1889 amounted to 182,967 short tons of refined lead as compared with 293,965 short tons in 1899, an increase of 110,998 short tons, or 60.7 per cent. On account of the different methods of treating the smelting industry prior to 1889, census figures which are comparable with those of 1899 are not available for these earlier years. Statistics of lead production, based on returns from the smelters of the country, have, however, been complied by the Geological Survey since 1873, and a condensation of these statistics is presented in Table 4.

TABLE 4.—PRODUCTION OF REFINED LEAD IN THE UNITED STATES FROM 1873 TO 1899.

| YEAR. | Total production. | Desilverized lead. | Soft lead. |
|---|---|---|---|
| | *Short tons.* | *Short tons.* | *Short tons.* |
| 1873 | 42,540 | 20,159 | 22,381 |
| 1874 | 52,080 | ..... | ..... |
| 1875 | 59,640 | 34,909 | 24,731 |
| 1876 | 64,070 | 37,649 | 26,421 |
| 1877 | 81,900 | 50,748 | 31,152 |
| 1878 | 91,060 | 64,290 | 26,770 |
| 1879 | 92,780 | 64,650 | 28,130 |
| 1880 | 97,825 | 70,135 | 27,690 |
| 1881 | 117,085 | 86,315 | 30,770 |
| 1882 | 132,890 | 103,875 | 29,015 |
| 1883 | 143,957 | 122,157 | 21,800 |
| 1884 | 139,897 | 119,965 | 19,932 |
| 1885 | 129,412 | 107,437 | 21,975 |
| 1886 | 135,629 | 114,829 | 20,800 |
| 1887 | 160,700 | 135,552 | 25,148 |
| 1888 | 180,555 | 151,465 | 29,090 |
| 1889 | 182,967 | 153,709 | 29,258 |
| 1890 | 161,754 | 130,403 | 31,351 |
| 1891 | 202,406 | 171,009 | 31,397 |
| 1892 | 213,262 | 181,584 | 31,678 |
| 1893 | 229,333 | 196,820 | 32,513 |
| 1894 | 219,090 | 181,404 | 37,686 |
| 1895 | 241,882 | 201,992 | 39,890 |
| 1896 | 264,994 | 221,457 | 43,537 |
| 1897 | 291,036 | 247,483 | 43,553 |
| 1898 | 310,621 | 267,842 | 42,779 |
| 1899 | 304,392 | 263,826 | 40,566 |

Table 5 shows the total production of lead in each state and territory for the year 1899 as reported by the 39 establishments included in this report.

TABLE 5.—PRODUCTION OF REFINED LEAD IN 1899, BY STATES AND TERRITORIES, IN SHORT TONS.

| STATES AND TERRITORIES. | Total. | Soft lead. | Hard or antimonial lead. | All other lead (including Doré bars). |
|---|---|---|---|---|
| United States | 293,965 | 45,237 | 8,393 | 240,335 |
| California | 8,945 | ..... | 596 | 8,349 |
| Colorado | 22,064 | ..... | 702 | 21,362 |
| Idaho | ..... | ..... | ..... | ..... |
| Illinois | 35,897 | 71 | 941 | 34,885 |
| Iowa | 400 | 400 | ..... | ..... |
| Kansas | 41,959 | 398 | 1,328 | 40,233 |
| Missouri | 41,976 | 41,976 | ..... | ..... |
| Montana | ..... | ..... | ..... | ..... |
| Nebraska | 59,381 | 2,119 | 2,624 | 54,638 |
| New Jersey | 80,856 | 113 | 2,202 | 78,541 |
| New Mexico | ..... | ..... | ..... | ..... |
| Texas | ..... | ..... | ..... | ..... |
| Utah | ..... | ..... | ..... | ..... |
| Virginia | 160 | 160 | ..... | ..... |
| Washington | 2,327 | ..... | ..... | 2,327 |

The total production, 293,965 short tons, for 1899, shown in Table 5, is 10,427 short tons less than the total shown in Table 4. This difference is due principally to the fact that in the returns of the United States Geological Survey the product of by far the greatest smelting interest, the American Smelting and Refining Company, is that of the calendar year, while the statistics for the Census Office, for the majority of the constituent plants, cover the fiscal year of that consolidation. The fiscal year was accepted because it was the first which had elapsed since the organization of the American Smelting and Refining Company. Moreover, a considerable tonnage of soft lead, which in the reports of the Survey is usually included with desilverized lead (since it is thus marketed), was, for the census report, segregated by two lead smelting and desilverizing plants.

The production of lead for the year 1899 was the largest in the history of the industry with the exception of that of the previous year, 1898. A large expenditure is necessary to the establishment of a fully equipped plant for the smelting and refining of ores, and this, combined with the location and character of the raw materials, has resulted in confining the industry to a few large establishments. Of the 39 establishments reported, 15 are owned by one company, which thus controls a large percentage of the product.

As shown by Table 4, there has been an almost constant increase in the quantity of lead produced, and while statistics showing the increase in capital, employees, or wages are not available, Table 2 shows that the industry had an invested capital of $72,148,933 in 1899, gave employment to 8,319 wage-earners, paid $5,088,684 in wages, while its products were valued at $175,466,304. The practice of using lead as the carrier for the precious metals, and thus extracting them more cheaply than by the older methods, largely increased the quantity of the precious-metal products. The value of the gold and silver included in the $175,466,304, shown as products in Table 2, amounted to $130,205,375, or 74.2 per cent of the total. In this connection it should be stated that the foregoing value is that of both smelted and refined gold and silver. The value of fine gold and silver included in the total value of products in Table 2 is $94,153,824; the difference, $36,051,551, is the value of gold and silver in base bullion of smelters in which refining and desilverizing are not a part of the process.

Table 6 presents the statistics for the establishments located east and west of the Mississippi, respectively.

TABLE 6.—LEAD, SMELTING AND REFINING: ESTABLISHMENTS BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER, 1900.[1]

| | United States. | East of the Mississippi. | West of the Mississippi. |
|---|---|---|---|
| Number of establishments | 39 | 5 | 34 |
| Capital | $72,148,933 | $8,975,079 | $63,173,854 |
| Salaried officials, clerks, etc., number | 425 | 36 | 389 |
| Salaries | $754,913 | $69,502 | $685,411 |
| Wage-earners, average number | 8,319 | 715 | 7,604 |
| Total wages | $5,088,684 | $453,787 | $4,634,897 |
| Miscellaneous expenses | $1,166,210 | $87,660 | $1,078,550 |

[1] This report is for the calendar year 1899.

TABLE 6.—LEAD, SMELTING AND REFINING: ESTABLISHMENTS BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER, 1900—Continued.[1]

| | United States. | East of the Mississippi. | West of the Mississippi. |
|---|---|---|---|
| Materials used, aggregate cost | $169,703,366 | $32,963,166 | $136,740,200 |
| Smelting, total cost | $60,868,480 | $1,208,568 | $59,659,912 |
| Domestic ore, tons | 1,667,545 | 464 | 1,667,081 |
| Cost | $53,532,321 | $15,520 | $53,516,801 |
| Foreign ore, tons | 284,914 | 12,921 | 271,993 |
| Cost | $7,336,159 | $1,193,048 | $6,143,111 |
| Refining, total cost | $100,802,504 | $30,688,133 | $70,114,371 |
| Domestic base bullion, tons | 180,998 | 45,000 | 135,998 |
| Cost | $80,940,771 | $12,006,867 | $68,933,904 |
| Foreign base bullion, tons | 78,939 | 76,810 | 2,129 |
| Cost | $19,861,733 | $18,681,266 | $1,180,467 |
| All other materials, including fuel, freight, mill supplies, etc., cost | $8,032,382 | $1,066,465 | $6,965,917 |
| Products, aggregate value | $200,974,507 | $38,992,943 | $161,981,564 |
| Smelting, total value | $81,142,773 | $1,507,583 | $79,635,190 |
| Nonargentiferous ores, total value | $4,114,336 | $29,610 | $4,084,726 |
| Soft lead, pounds | 90,478,286 | 686,703 | 89,786,583 |
| Value | $3,801,242 | $29,610 | $3,771,632 |
| Lead oxide, pounds | 10,329,804 | ..... | 10,329,804 |
| Value | $299,201 | ..... | $299,201 |
| Argentiferous ores, total value | $77,028,437 | $1,477,973 | $75,550,464 |
| Lead contents of base bullion, pounds | 402,324,605 | 1,523,330 | 400,801,275 |
| Value | $15,546,661 | $57,024 | $15,489,637 |
| Silver, fine ounces | 52,641,752 | 2,043,033 | 50,598,719 |
| Value | $31,185,203 | $1,217,369 | $29,967,834 |
| Gold, fine ounces | 1,322,177 | 8,825 | 1,313,352 |
| Value | $26,528,171 | $178,580 | $26,349,591 |
| Copper contents of matte, pounds | 26,964,031 | 150,000 | 26,814,031 |
| Value | $3,768,402 | $25,000 | $3,743,402 |
| Refining and desilverizing, total value | $115,527,046 | $35,539,270 | $79,987,776 |
| Hard or antimonial lead, pounds | 16,785,097 | 6,286,000 | 10,499,097 |
| Value | $701,082 | $262,912 | $438,170 |
| All other lead (including Doré bars), pounds | 480,670,834 | 226,852,000 | 253,818,834 |
| Value | $20,672,140 | $9,663,961 | $11,008,179 |
| Doré bars, contents of precious metals, total value | $94,153,824 | $25,612,397 | $68,541,427 |
| Silver, fine ounces | 70,420,917 | 31,619,725 | 38,801,192 |
| Value | $42,143,703 | $18,908,707 | $23,234,996 |
| Gold, fine ounces | 2,514,336 | 325,141 | 2,189,695 |
| Value | $52,010,121 | $6,703,690 | $45,306,431 |
| All other products, value | $4,318,581 | $1,946,090 | $2,372,491 |

[1] This report is for the calendar year 1899.

From Table 6 it appears that 34 of the 39 establishments are located west of the Mississippi. The total capitalization of these establishments was $63,173,854, or 87.6 per cent of the total for the industry. They gave employment to 7,604 wage-earners, or 91.4 per cent of the total, and their yearly wages amounted to $4,634,897, or 91.1 per cent of the total. Their products were valued at $161,981,564, or 80.6 per cent of the total value of all products. The establishments located in the Western states were engaged largely in the smelting of ores, as indicated by the fact that the cost of the ores consumed by them was $59,659,912, being 98 per cent of the total cost of all ores.

The object of the inquiry of the Twelfth Census regarding the smelting and refining of lead was to obtain from each establishment such information as would make it possible to present separately the statistics for both branches of the industry when carried on either in the same or in separate plants. Under these conditions it was necessary to ascertain the quantities and values of the materials and products of the smelters and refineries, respectively. In 8 establishments both processes were carried on. Two of these establishments produced 4,463,312 pounds of soft lead, valued at $176,574, from nonargentiferous ore. Besides this, there were 119,019,138 pounds of lead, valued at $4,952,228; 19,570,396 ounces fine of silver, valued at $11,483,315; 646,142 ounces fine of gold, valued at $13,120,675; and 6,496,137 pounds of copper contents of matte, valued at $983,392, reported as the products of the smelting plants of these 8 establishments (or an aggregate product of $30,539,610 from smelting argentiferous ores). Of these products, 90,412,486 pounds of lead, 16,784,853 ounces fine of silver, and 580,178 ounces fine of gold, the aggregate value of which amounted to $25,508,203, were again charged as materials for the refinery, and ultimately appear in the finished products of the establishments.

As practically the entire product of the smelters, with the exception of those smelting nonargentiferous ore, ultimately reaches the refinery as its raw material, the extent of duplication in the aggregate cost of materials and products for all establishments engaged in both branches of the industry is much greater than is indicated by these figures. It is, however, only when materials and products are twice included in the report for the same establishment that they are considered as duplicated in the statistics presented in this report. While it is necessary to include this duplication of quantities and values in statistics showing the totals for the different materials and products of the smelters and refiners, respectively, they have been eliminated from Table 2, in which the original cost of materials and final value of products only are presented for the entire industry.

Of the 39 establishments reported, 30 were engaged in smelting only, 1 in refining and desilverizing, and 8 in both branches of the industry. Of the 38 smelters, 37 reported the consumption of domestic ore amounting to 1,667,545 short tons, valued at $53,532,321, and

9 the consumption of 284,914 short tons of foreign ore, valued at $7,336,159. The 9 refiners and desilverizers reported the consumption of 180,998 tons of base bullion from domestic smelters, valued at $80,940,771, and 5 the consumption of 78,939 tons of foreign base bullion, valued at $19,861,733.

Table 7 shows the quantities of domestic and foreign ores, and of base bullion, respectively, consumed by smelters and refineries in each of the states and territories in which the industry appeared in 1899.

TABLE 7.—QUANTITIES OF ORE SMELTED AND BASE BULLION REFINED AND DESILVERIZED: 1900.[1]

| STATES AND TERRITORIES. | SMELTERS. | | REFINERS AND DESILVERIZERS. | |
|---|---|---|---|---|
| | Domestic ore. | Foreign ore. | Domestic base bullion. | Foreign base bullion. |
| United States | *Short tons.* 1,667,545 | *Short tons.* 284,914 | *Short tons.* 180,998 | *Short tons.* 78,939 |
| California | 34,860 | 5,600 | 10,462 | ..... |
| Colorado | 1,050,957 | 932 | 25,794 | ..... |
| Idaho | 3,402 | ..... | ..... | ..... |
| Illinois | 90 | ..... | 36,572 | 2,497 |
| Iowa | 400 | ..... | ..... | ..... |
| Kansas | 19,278 | ..... | 46,767 | 660 |
| Missouri | 68,719 | ..... | ..... | ..... |
| Montana | 145,364 | 3,750 | ..... | ..... |
| Nebraska | 32,211 | 3,726 | 52,096 | ..... |
| New Jersey | 149 | 12,921 | 8,428 | 74,313 |
| New Mexico | 15,122 | ..... | ..... | ..... |
| Texas | 84,295 | 252,887 | ..... | ..... |
| Utah | 171,034 | ..... | ..... | ..... |
| Virginia | 225 | ..... | ..... | ..... |
| Washington | 41,439 | 5,098 | 879 | 1,469 |

[1] This report is for the calendar year 1899.

As shown by Table 7, 284,914 tons, or but 14.6 per cent of the total quantity of ores consumed in smelters, were imported, while of the 259,937 tons of base bullion credited to refineries and desilverizers, 78,939 tons, or 30.4 per cent, were imported—a difference to be accounted for by the fact that considerable quantities of foreign ore are smelted before being sent into the country, only the refining and desilverizing being done here, almost entirely in bond. Of the total quantity (284,914 tons) of foreign ores consumed in smelters, 252,887 tons, or 88.8 per cent, were consumed in Texas. A large part of this ore is imported from Mexico and smelted near the border. Of the 78,939 tons of foreign base bullion consumed in the refineries and desilverizers, 74,313 tons, or 94.1 per cent, were reported by the refineries of the state of New Jersey. How little of this foreign lead remains in the United States is shown by Table 13, 148,300,164 pounds of foreign lead, valued at $5,517,569, being desilverized and refined in bond and reexported.

Table 8 gives the quantities and value of the different classes of products and the number of establishments reporting each class.

TABLE 8.—QUANTITIES AND VALUE OF PRODUCTS AND NUMBER OF ESTABLISHMENTS REPORTING EACH CLASS: 1900.[1]

| CLASS. | Number of establishments reporting. | Unit of measure. | Quantities. | Values. |
|---|---|---|---|---|
| Smelting nonargentiferous ores: | | | | |
| Soft lead | 17 | Pounds.. | 90,473,286 | $3,801,242 |
| Lead oxide | 3 | Pounds.. | 10,329,804 | 299,201 |
| Smelting argentiferous ores: | | | | |
| Lead contents of base bullion | 23 | Pounds.. | 402,324,605 | 15,546,661 |
| Silver | 23 | Oz. fine.. | 52,641,752 | 31,185,203 |
| Gold | 22 | Oz. fine.. | 1,322,177 | 26,528,171 |
| Copper contents of matte | 19 | Pounds.. | 26,964,031 | 3,768,402 |
| Refining and desilverizing: | | | | |
| Hard or antimonial lead | 8 | Pounds.. | 16,785,097 | 701,082 |
| All other lead (including Doré bars) | 9 | Pounds.. | 480,670,834 | 20,672,140 |
| Doré bars—contents of silver | 9 | Oz. fine.. | 70,420,917 | 42,143,703 |
| Doré bars—contents of gold | 9 | Oz. fine.. | 2,514,836 | 52,010,121 |

[1] This report is for the calendar year 1899.

The quantities and values shown in Table 8 are the totals for smelting and refining, respectively, and include the duplications that arise when both branches of the industry are carried on by the same establishment.

There were 15 establishments engaged in smelting nonargentiferous ores only, 21 in smelting argentiferous only, and 2 in smelting both varieties of ores. Table 8 shows that all the 17 establishments using nonargentiferous ores were engaged in the production of soft lead, the total quantity produced being 90,473,286 pounds, valued at $3,801,242. Three establishments produced 10,329,804 pounds of lead oxide, valued at $299,201.

Silver is the product of greatest value for the establishments smelting argentiferous ores; 23 establishments reported 52,641,752 ounces, valued at $31,185,203, while 22 establishments reported 1,322,177 ounces of gold, valued at $26,528,171. Gold is the product of chief value for the refineries, 9 establishments reporting 2,514,836 ounces, valued at $52,010,121, as compared with 70,420,917 ounces of silver, valued at $42,143,703. The total lead product of the refineries was valued at $21,373,222, while the product of gold and silver was valued at $94,153,824.

Table 9 shows the quantities of the different varieties of products for each of the states and territories in which the industry appeared in 1899.

TABLE 9.—QUANTITIES OF PRODUCTS, BY STATES: 1900.[1]

| STATES AND TERRITORIES. | SMELTING. | | | | | | REFINING AND DESILVERIZING. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Nonargentiferous ores. | | Argentiferous ores. | | | | Hard or antimonial lead. | All other lead (including Doré bars). | Doré bars, contents of precious metals. | |
| | Soft lead. | Lead oxide. | Lead contents of base bullion. | Silver. | Gold. | Copper contents of matte. | | | Silver. | Gold. |
| United States | *Pounds.* 90,473,286 | *Pounds.* 10,329,804 | *Pounds.* 402,324,605 | *Oz. fine.* 52,641,752 | *Oz. fine.* 1,322,177 | *Pounds.* 26,964,031 | *Pounds.* 16,785,097 | *Pounds.* 480,670,834 | *Oz. fine.* 70,420,917 | *Oz. fine.* 2,514,836 |
| California | | | 10,960,000 | 2,339,000 | 98,640 | 569,000 | 1,192,666 | 16,697,334 | 6,995,000 | 1,119,940 |
| Colorado | | | 219,304,385 | 24,464,621 | 760,240 | 9,269,744 | 1,402,948 | 42,723,944 | 5,709,336 | 234,763 |
| Idaho | | | 1,315,178 | 109,248 | 174 | | | | | |
| Illinois | 141,025 | | | | | | 1,882,000 | 69,770,000 | 9,214,029 | 137,048 |
| Iowa | 800,645 | | | | | | | | | |
| Kansas | 795,798 | | 21,842,738 | 2,208,295 | 88,622 | 1,629,706 | 2,654,608 | 80,466,519 | 11,078,966 | 418,571 |
| Missouri | 83,952,833 | 10,329,804 | | | | | | | | |
| Montana | | | 40,853,057 | 4,356,099 | 54,415 | 791,162 | | | | |
| Nebraska | 4,237,312 | | 7,463,762 | 3,997,860 | 175,459 | 3,421,248 | 5,248,875 | 109,275,630 | 14,352,804 | 402,127 |
| New Jersey | 226,000 | | 1,523,330 | 2,043,033 | 8,825 | 150,000 | 4,404,000 | 157,082,000 | 22,405,696 | 188,093 |
| New Mexico | | | 3,713,281 | 128,323 | | 3,588 | | | | |
| Texas | | | 26,476,173 | 6,700,207 | 40,937 | 4,676,641 | | | | |
| Utah | | | 51,053,513 | 4,982,919 | 42,112 | 6,014,360 | | | | |
| Virginia | 319,678 | | | | | | | | | |
| Washington | | | 17,819,188 | 1,222,147 | 52,753 | 438,582 | | 4,655,407 | 605,086 | 14,294 |

[1] This report is for the calender year 1899.

The most important fact indicated by this table is the geographical distribution of the two branches of the industry. This distribution in each case has but slight relation to the location of the mines producing the ores used, but the relation is least apparent in the case of the refineries and desilverizers. The location of lead smelters is largely decided by the abundance of "dry ores" of the precious metals—ores which are free from lead—and by the abundance of fuel. These "dry ores" can be reduced more economically in lead smelters than is possible by amalgamation or other processes used for the extraction of gold and silver. There are a few relatively unimportant smelting plants in Idaho, Montana, New Mexico, and California, built to reduce the lead ores locally mined. The great mass of lead ore, however, is hauled, often great distances, to meet the fuel and to encounter "dry ores" of gold and silver. The principal large plants are in Colorado, Utah, and Montana. An excellent illustration of this movement is afforded by the famous Coeur d'Alene district in Idaho, which yields approximately one-quarter of the lead mined in the United States. Not a pound of the ore of this district is smelted locally, the concentrates and ore being shipped for reduction to the smelters in Colorado, Montana, Utah, Nebraska, Illinois, and on Puget Sound. Thus the smelters of Colorado produced 219,304,385 pounds of lead, or 54.5 per cent of the lead produced from argentiferous ores in all the smelters of the country, 24,464,621 fine ounces of silver, and 760,240 fine ounces of gold, or 46.5 per cent and 57.5 per cent, respectively, of the gold and silver product of all smelters. This preeminence is partly due to the large production of lead ores in Colorado, amounting to nearly one-third of the country's production in 1899,[1] but partly also to the large production of "dry ores" of gold and silver and the production of coking coal, which latter, as explained above, combine to attract to this state lead ores mined in other parts of the country. The smelting of nonargentiferous or soft lead ores is very largely carried on in the state of Missouri, which is also the center of the region where these ores are chiefly mined. Of the entire production of soft lead, 83,952,833 pounds, or 92.8 per cent, came from the smelters of Missouri. In this state was also manufactured the entire product of lead oxide herein reported.

The distribution of refineries and desilverizers is very different from that of the smelters. While the smelting of argentiferous ores is centered largely in Colorado, Utah, and Montana, the refining and desilverizing is carried on more largely in New Jersey, Nebraska, and Kansas.

In Table 10 the statistics for the 30 establishments engaged in smelting exclusively, and those for the 1 engaged in refining, combined with the 8 establishments engaged in both branches of the industry, are separately given.

[1] Annual Report United States Geological Survey, Part VI. Mineral Resources of the United States, 1899, Metallic Products, Production of Lead in 1899, page 229.

TABLE 10.—ESTABLISHMENTS CLASSIFIED ACCORDING TO CHARACTER OF WORK DONE: 1900.[1]

| | Total. | Smelting only. | Smelting and refining. |
|---|---|---|---|
| Number of establishments | 39 | 30 | 9 |
| Capital | $72,148,033 | $21,796,609 | $50,352,324 |
| Salaried officials, clerks, etc., number | 425 | 225 | 200 |
| Salaries | $754,913 | $427,000 | $327,913 |
| Wage-earners, average number | 8,319 | 5,635 | 2,684 |
| Total wages | $5,088,684 | $3,209,779 | $1,878,905 |

[1] This report is for the calendar year 1899.

TABLE 10.—ESTABLISHMENTS CLASSIFIED ACCORDING TO CHARACTER OF WORK DONE: 1900—Continued.[1]

| | Total. | Smelting only. | Smelting and refining. |
|---|---|---|---|
| Miscellaneous expenses | $1,166,210 | $730,773 | $435,437 |
| Materials used, aggregate cost | $169,703,366 | $42,875,982 | $126,827,384 |
| Smelting, total cost | $60,868,480 | $38,738,064 | $22,130,416 |
| Domestic ore— | | | |
| Tons | 1,667,545 | 1,237,002 | 430,543 |
| Cost | $53,532,321 | $34,500,790 | $19,031,531 |
| Foreign ore— | | | |
| Tons | 284,914 | 259,063 | 25,851 |
| Cost | $7,336,159 | $4,237,274 | $3,098,885 |
| Refining, total cost | $100,802,504 | ..... | $100,802,504 |
| Domestic base bullion— | | | |
| Tons | 180,998 | ..... | 180,998 |
| Cost | $80,940,771 | ..... | $80,940,771 |
| Foreign base bullion— | | | |
| Tons | 78,939 | ..... | 78,939 |
| Cost | $19,861,733 | ..... | $19,861,733 |
| All other materials | $8,032,382 | $4,137,918 | $3,894,464 |
| Products, aggregate value | $200,974,507 | $50,696,417 | $150,278,090 |
| Smelting, total value | $81,142,773 | $50,426,589 | $30,716,184 |
| Nonargentiferous ores, total value | $4,114,336 | $3,937,762 | $176,574 |
| Soft lead— | | | |
| Pounds | 90,473,286 | 86,009,974 | 4,463,312 |
| Value | $3,801,242 | $3,624,668 | $176,574 |
| Lead oxide— | | | |
| Pounds | 10,329,804 | 10,329,804 | ..... |
| Value | $299,201 | $299,201 | ..... |
| Argentiferous ores, total value | $77,028,437 | $46,488,827 | $30,539,610 |
| Lead contents of base bullion— | | | |
| Pounds | 402,324,605 | 283,305,467 | 119,019,138 |
| Value | $15,546,661 | $10,594,433 | $4,952,228 |
| Silver— | | | |
| Fine ounces | 52,641,752 | 33,071,356 | 19,570,396 |
| Value | $31,185,203 | $19,701,888 | $11,483,315 |
| Gold— | | | |
| Fine ounces | 1,322,177 | 676,035 | 646,142 |
| Value | $26,528,171 | $13,407,496 | $13,120,675 |
| Copper contents of matte— | | | |
| Pounds | 26,964,031 | 20,467,894 | 6,496,137 |
| Value | $3,768,402 | $2,785,010 | $983,392 |
| Refining and desilverizing, total value | $115,527,046 | ..... | $115,527,046 |
| Hard or antimonial lead— | | | |
| Pounds | 16,785,097 | ..... | 16,785,097 |
| Value | $701,082 | ..... | $701,082 |
| All other lead, including Doré bars— | | | |
| Pounds | 480,670,834 | ..... | 480,670,834 |
| Value | $20,672,140 | ..... | $20,672,140 |
| Doré bars, contents of precious metals— | | | |
| Total value | $94,153,824 | ..... | $94,153,824 |
| Silver— | | | |
| Fine ounces | 70,420,917 | ..... | 70,420,917 |
| Value | $42,143,703 | ..... | $42,143,703 |
| Gold— | | | |
| Fine ounces | 2,514,836 | ..... | 2,514,836 |
| Value | $52,010,121 | ..... | $52,010,121 |
| All other products, value | $4,318,581 | $283,721 | $4,034,860 |

[1] This report is for the calendar year 1899.

The materials and products shown in Table 10 include the value of the intermediate products made and consumed in the same establishments. Therefore the total cost of materials and value of products do not agree with the totals given in Table 2.

In the census of 1890 certain groups of smelters were segregated in order to furnish some data bearing upon the characteristics of smelting in different districts. Conspicuous among these were the Colorado smelters, all of which purchase lead ores in the open market and smelt them with "dry ores." The smelters of the state were divided into two groups, those of the Leadville district and those of the Valley, the latter including the two great smelting centers, Pueblo and Denver. At that time only one of the works possessed a desilverizing plant also, and was excluded on that account. In the census year 1899 there were 2 smelting concerns which were engaged in desilverizing also, and therefore could not be included. Consequently identical plants do not figure in the comparison given in Table 11, and during the decade which has elapsed some changes have occurred in the relative importance of the works. But on one or two points numerical expression is given to the progress made in the ten years.

TABLE 11.—STATISTICS OF COLORADO SMELTERS

[Exclusive of works with desilverizing plants.]

| | 1889 | 1899 |
|---|---|---|
| Total expenses | $4,014,415 | $3,526,701 |
| Wages | $1,570,820 | $1,714,836 |
| Salaries | $191,607 | $182,412 |
| Supplies and materials, not including ore | $1,717,351 | $1,540,381 |
| Taxes, rent, insurance, and all other expenditures | $503,639 | $89,072 |
| Paid contractors | $30,998 | ..... |
| Ore treated, short tons | 589,014 | 711,371 |
| Product of lead, short tons | [1] 66,706 | [2] 73,363 |

[1] Base bullion. [2] Lead contents of base bullion.

It is obvious that the subdivision of general expenses was different at the two periods, so that no deductions can be drawn from the data other than those of wages and salaries. The figures show a reduction in labor cost from $2.67 per short ton of ore smelted in the year 1889 to $2.41 per short ton in the year 1899. The cost of salaries per ton of ore smelted is also lower. However, it should not be inferred that the rates of wages and salaries have decreased in the industry.

In the report for the year 1889 attention was called to the small quantity of lead in the furnace mixture, that being a notable achievement of American metallurgical practice. It was not possible then to determine exactly the yield of lead from the ores treated, because the returns gave only the crude base bullion product, inclusive of silver contents. It was estimated that the average yield of lead from the mixtures was between 11 and 11.5 per cent. The reports of the smelters in the year 1899 show the actual lead contents of the base bullion produced in smelting, so that it is possible to state that the yield of lead from the ores treated averaged 10.3 per cent for the whole group of Colorado smelters included in Table 11. The statistics do not reflect the progress that has been made in the direction of the reduction of losses of the base and precious metals in smelting by making cleaner slags and by more effective recovery of flue dust.

The conditions surrounding the smelting of the non-argentiferous ores mined in Missouri, Kansas, Iowa, and Wisconsin are entirely different. Since only a very small number of smelters of this group are located in other states, the statistics of the works in Missouri may be selected as typical. All of them smelt high-grade lead concentrates with no admixture whatever of ores drawn from other sources. All the important producers whose returns entered into the statistics of 1889 are included in the list for the year 1899.

TABLE 12.—STATISTICS OF MISSOURI SMELTERS.

| | 1889[1] | 1899 |
|---|---|---|
| Total expenses | $680,210 | $530,693 |
| Wages | $206,541 | $255,590 |
| Salaries | $19,680 | $47,360 |
| Paid contractors | $3,182 | $25,382 |
| Supplies and materials, not including ore | $184,175 | $160,796 |
| Rent, taxes, insurance, and all other expenditures | $166,632 | $41,565 |
| Quantity of ore treated, short tons | 49,816 | 68,719 |
| Lead produced, short tons | 29,258 | 41,976 |
| Oxide produced, short tons | 1,250 | 5,165 |

[1] Includes the data for Illinois, Kansas, Missouri, and Wisconsin.

The labor cost per ton of ore treated, as indicated by the foregoing table, has declined from $4.15 in 1889 to $3.72 in 1899.

The detailed statistics for the smelting and refining industry, as reported at the census of 1900, are shown in Table 13. This table presents separate totals for each state in which there were 3 or more establishments, and groups the statistics for other states so as not to disclose the operations of individual establishments. The establishments are classified according to the character of the ownership, which shows that 5 were owned by individuals, 1 by a partnership, and 33 by corporations. The employees are segregated so as to show for salaried officials and wage-earners separately the number and salaries or wages of men, women, and children, respectively, and also the average number of wage-earners employed during each month of the year. Separate totals are shown for the different materials and products of smelting and refining, respectively. Considerable quantities of ore are smelted or refined on contract. The amounts received for contract work, aggregating $1,598,038, are given in the table, and the ores thus treated are included in the quantities and values of the materials and products. The number of engines, water wheels, etc., and their horsepower, are presented and the 39 establishments are grouped according to the number of employees in each.

TABLE 13.—LEAD, SMELTING AND REFINING, BY STATES AND TERRITORIES: 1900.[1]

| | United States. | Colorado. | Missouri. | Montana. | All other states and territories.[2] |
|---|---|---|---|---|---|
| Number of establishments | 39 | 8 | 11 | 3 | 17 |
| Character of organization: | | | | | |
| Individual | 5 | ..... | 1 | ..... | 4 |
| Firm and limited partnership | 1 | ..... | 1 | ..... | ..... |
| Incorporated company | 33 | 8 | 9 | 3 | 13 |
| Capital: | | | | | |
| Total value | $72,148,933 | $22,569,715 | $944,539 | $2,858,158 | $45,776,521 |
| Land | $3,704,552 | $1,057,264 | $107,000 | $63,334 | $2,476,954 |
| Buildings | $21,974,850 | $7,064,040 | $269,550 | $939,953 | $13,701,307 |
| Machinery, tools, and implements | $26,480,025 | $8,752,414 | $61,128 | $1,191,663 | $16,474,820 |
| Cash and sundries | $19,989,506 | $5,695,997 | $506,861 | $663,208 | $13,123,440 |
| Proprietors and firm members | 7 | ..... | 3 | ..... | 4 |
| Salaried officials, clerks, etc.: | | | | | |
| Total number | 425 | 137 | 35 | 27 | 226 |
| Total salaries | $754,913 | $288,119 | $47,360 | $73,818 | $345,616 |
| Officers of corporations— | | | | | |
| Number | 20 | ..... | 8 | 4 | 8 |
| Salaries | $66,905 | ..... | $15,200 | $17,700 | $34,005 |
| General superintendents, managers, clerks, etc.— | | | | | |
| Total number | 405 | 137 | 27 | 23 | 218 |
| Total salaries | $688,008 | $288,119 | $32,160 | $56,118 | $311,611 |
| Men— | | | | | |
| Number | 402 | 137 | 26 | 22 | 217 |
| Salaries | $685,428 | $288,119 | $31,560 | $54,858 | $310,891 |
| Women— | | | | | |
| Number | 3 | ..... | 1 | 1 | 1 |
| Salaries | $2,580 | ..... | $600 | $1,260 | $720 |

[1] This report is for the calendar year 1899.
[2] Includes establishments distributed as follows: California, 1; Idaho, 1; Illinois, 2; Iowa, 1; Kansas, 2; Nebraska, 1; New Jersey, 2; New Mexico, 1; Texas, 1; Utah, 2; Virginia, 1; Washington, 2.

TABLE 13.—LEAD, SMELTING AND REFINING, BY STATES AND TERRITORIES: 1900—Continued.[1]

| | United States. | Colorado. | Missouri. | Montana. | All other states and territories.[2] |
|---|---|---|---|---|---|
| Wage-earners, including pieceworkers, and total wages: | | | | | |
| Greatest number employed at any one time during the year | 10,143 | 4,247 | 598 | 717 | 4,581 |
| Least number employed at any one time during the year | 6,778 | 2,539 | 398 | 464 | 3,377 |
| Average number | 8,319 | 3,316 | 474 | 563 | 3,966 |
| Wages | $5,088,684 | $2,390,383 | $255,590 | $397,771 | $2,044,940 |
| Men, 16 years and over— | | | | | |
| Average number | 8,312 | 3,316 | 473 | 563 | 3,960 |
| Wages | $5,086,704 | $2,390,383 | $255,362 | $397,771 | $2,043,188 |
| Children, under 16 years— | | | | | |
| Average number | 7 | | 1 | | 6 |
| Wages | $1,980 | | $228 | | $1,752 |
| Average number of wage-earners, including pieceworkers, employed during each month: | | | | | |
| Men, 16 years and over— | | | | | |
| January | 8,806 | 3,655 | 399 | 604 | 4,148 |
| February | 8,186 | 3,444 | 384 | 584 | 3,774 |
| March | 8,383 | 3,235 | 487 | 568 | 4,093 |
| April | 8,565 | 3,505 | 487 | 525 | 4,048 |
| May | 8,018 | 3,240 | 427 | 543 | 3,808 |
| June | 7,330 | 2,470 | 466 | 515 | 3,879 |
| July | 7,139 | 2,240 | 526 | 488 | 3,885 |
| August | 8,068 | 3,277 | 496 | 453 | 3,842 |
| September | 8,608 | 3,630 | 503 | 545 | 3,930 |
| October | 8,779 | 3,690 | 514 | 601 | 3,974 |
| November | 8,947 | 3,670 | 488 | 617 | 4,172 |
| December | 8,915 | 3,734 | 498 | 715 | 3,968 |
| Children, under 16 years— | | | | | |
| January | 7 | | 1 | | 6 |
| February | 7 | | 1 | | 6 |
| March | 7 | | 1 | | 6 |
| April | 7 | | 1 | | 6 |
| May | 7 | | 1 | | 6 |
| June | 7 | | 1 | | 6 |
| July | 7 | | 1 | | 6 |
| August | 7 | | 1 | | 6 |
| September | 7 | | 1 | | 6 |
| October | 7 | | 1 | | 6 |
| November | 7 | | 1 | | 6 |
| December | 7 | | 1 | | 6 |
| Miscellaneous expenses: | | | | | |
| Total | $1,166,210 | $154,001 | $41,565 | $47,626 | $923,018 |
| Rental of works | $2,626 | | | | $2,626 |
| Taxes, not including internal revenue | $86,390 | $32,269 | $5,601 | $8,596 | $39,924 |
| Rent of offices, insurance, interest, and all sundry expenses not hitherto included | $1,077,194 | $121,732 | $35,964 | $39,030 | $880,468 |
| Materials used:[3] | | | | | |
| Aggregate cost | $169,703,366 | $43,201,710 | $3,317,558 | $4,835,771 | $118,348,327 |
| Smelters— | | | | | |
| Total cost | $65,789,219 | $33,166,211 | $3,285,190 | $4,308,806 | $25,029,012 |
| Ores— | | | | | |
| Domestic— | | | | | |
| Tons | 1,667,545 | 1,050,957 | 68,719 | 145,364 | 402,505 |
| Cost | $53,532,321 | $30,862,018 | $3,124,394 | $3,676,436 | $15,869,473 |
| Foreign— | | | | | |
| Tons | 284,914 | 932 | | 3,750 | 280,232 |
| Cost | $7,336,159 | $313,385 | | $184,099 | $6,838,675 |
| Fuel | $3,191,236 | $1,392,316 | $104,607 | $356,380 | $1,337,933 |
| Rent of power and heat | $26,446 | | | $13,958 | $12,488 |
| Mill supplies | $504,530 | $344,059 | $16,010 | $28,345 | $116,116 |
| All other materials | $1,198,527 | $254,433 | $40,179 | $49,588 | $854,327 |
| Refiners and desilverizers: | | | | | |
| Total cost | $102,096,628 | $9,939,214 | | | $92,157,414 |
| Base bullion— | | | | | |
| Domestic— | | | | | |
| Tons | 180,998 | 25,794 | | | 155,204 |
| Cost | $80,940,771 | $9,879,781 | | | $71,060,990 |
| Foreign— | | | | | |
| Tons | 78,939 | | | | 78,939 |
| Cost | $19,861,733 | | | | $19,861,733 |
| Fuel | $250,519 | $18,435 | | | $232,084 |
| Mill supplies | $104,670 | $9,183 | | | $95,487 |
| All other materials | $938,935 | $31,815 | | | $907,120 |
| Freight | $1,817,519 | $96,285 | $32,368 | $526,965 | $1,161,901 |
| Products:[3] | | | | | |
| Aggregate value | $200,974,507 | $49,937,006 | $3,852,435 | $5,264,253 | $141,920,813 |
| Smelting— | | | | | |
| Total value | $81,430,717 | $39,772,746 | $3,852,435 | $5,264,253 | $32,541,283 |
| Nonargentiferous ores— | | | | | |
| Total value | $4,114,336 | | $3,852,435 | | $261,901 |
| Soft lead— | | | | | |
| Pounds | 90,473,286 | | 83,952,833 | | 6,520,453 |
| Value | $3,801,242 | | $3,539,341 | | $261,901 |
| Lead oxide— | | | | | |
| Pounds | 10,329,804 | | 10,329,804 | | |
| Value | $299,201 | | $299,201 | | |
| All other products of nonargentiferous ores— | | | | | |
| Value | $13,893 | | $13,893 | | |
| Contract work on nonargentiferous ores[4] | $25,382 | | $25,382 | | |
| Argentiferous ores— | | | | | |
| Total value | $77,316,381 | $39,772,746 | | $5,264,253 | $32,279,382 |
| Lead contents of base bullion— | | | | | |
| Pounds | 402,324,605 | 219,304,385 | | 40,853,057 | 142,167,163 |
| Value | $15,546,661 | $8,613,296 | | $1,382,515 | $5,550,850 |
| Silver— | | | | | |
| Ounces fine | 52,641,752 | 24,464,621 | | 4,356,099 | 23,821,032 |
| Value | $31,185,208 | $14,680,889 | | $2,550,556 | $13,953,758 |

[1] This report is for the calendar year 1899.

[2] Includes establishments distributed as follows: California, 1; Idaho, 1; Illinois, 2; Iowa, 1; Kansas, 2; Nebraska, 1; New Jersey, 2; New Mexico, 1; Texas, 1; Utah, 2; Virginia, 1; Washington, 2.

[3] The differences between the cost of materials, and also for value of products for Colorado, all other states, and the United States total as shown above, and as shown in Table I, is caused by the duplication in the above table, under the heads of "refining and desilverizing base bullion," and "smelting argentiferous ores," to the amount of $9,204,735 for Colorado, $16,303,468 for all other states, and $25,508,203 for the United States, which amounts represent the intermediate product between the ore and the refined metal.

[4] The amount of this contract work is distributed among the various items to which it properly belongs, and is not, therefore, included in the value of the products as a single item.

TABLE 13.—LEAD, SMELTING AND REFINING, BY STATES AND TERRITORIES: 1900—Continued.[1]

| | United States. | Colorado. | Missouri. | Montana. | All other states and territories.[2] |
|---|---|---|---|---|---|
| Products—Continued. | | | | | |
| Argentiferous ores—Continued. | | | | | |
| Total value—Continued. | | | | | |
| Gold— | | | | | |
| Ounces fine | 1,322,177 | 760,240 | | 54,415 | 507,522 |
| Value | $26,528,171 | $15,194,872 | | $1,088,992 | $10,244,307 |
| Copper contents of matte— | | | | | |
| Pounds | 26,964,031 | 9,269,744 | | 791,162 | 16,903,125 |
| Value | $3,768,402 | $1,276,850 | | $76,881 | $2,414,671 |
| All other products of argentiferous ores— | | | | | |
| Value | $287,944 | $6,839 | | $165,809 | $115,796 |
| Contract work on argentiferous ores[3] | $118,407 | | | | $118,407 |
| Refining and desilverizing— | | | | | |
| Total value | $119,543,790 | $10,164,260 | | | $109,379,530 |
| Hard or antimonial lead— | | | | | |
| Pounds | 16,785,097 | 1,402,948 | | | 15,382,149 |
| Value | $701,082 | 59,156 | | | $641,926 |
| All other lead (including Doré bars)— | | | | | |
| Pounds | 480,670,834 | 42,728,944 | | | 437,946,890 |
| Value | $20,672,140 | $1,822,735 | | | $18,849,405 |
| Doré bars, contents of precious metals— | | | | | |
| Silver— | | | | | |
| Ounces fine | 70,420,917 | 5,769,336 | | | 64,651,581 |
| Value | $42,143,703 | $3,429,993 | | | $38,713,710 |
| Gold— | | | | | |
| Ounces fine | 2,514,836 | 234,763 | | | 2,280,073 |
| Value | $52,010,121 | $4,852,376 | | | $47,157,745 |
| All other products of refining and desilverizing— | | | | | |
| Value | $4,016,744 | | | | $4,016,744 |
| Contract work on refining and desilverizing[3] | $1,454,249 | | | | $1,454,249 |
| Foreign lead smelted or refined in bond and reexported— | | | | | |
| Pounds | 148,300,164 | | | | 148,300,164 |
| Value | $5,517,569 | | | | $5,517,569 |
| Power: | | | | | |
| Number of establishments reporting | 36 | 7 | 9 | 3 | 17 |
| Owned— | | | | | |
| Total horsepower | 16,952 | 7,590 | 880 | 1,295 | 7,287 |
| Engines— | | | | | |
| Steam— | | | | | |
| Number | 171 | 60 | 21 | 4 | 86 |
| Horsepower | 13,948 | 6,747 | 880 | 500 | 5,871 |
| Gas or gasoline— | | | | | |
| Number | 5 | 2 | | | 3 |
| Horsepower | 159 | 89 | | | 70 |
| Water wheels— | | | | | |
| Number | 14 | 5 | | 1 | 8 |
| Horsepower | 373 | 92 | | 40 | 241 |
| Electric motors— | | | | | |
| Number | 12 | 4 | | | 8 |
| Horsepower | 610 | 235 | | | 375 |
| Other power— | | | | | |
| Horsepower | 452 | 427 | | | 25 |
| Rented horsepower | 1,410 | | | 755 | 655 |
| Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | |
| Total number of establishments | 39 | 8 | 11 | 3 | 17 |
| Under 5 | 3 | | 2 | | 1 |
| 5 to 20 | 4 | | 1 | | 3 |
| 21 to 50 | 6 | | 4 | 1 | 1 |
| 51 to 100 | 4 | | 2 | | 2 |
| 101 to 250 | 8 | 2 | 2 | 1 | 3 |
| 251 to 500 | 6 | 2 | | | 4 |
| 501 to 1,000 | 5 | 2 | | 1 | 2 |
| Over 1,000 | 3 | 2 | | | 1 |

[1] This report is for the calendar year 1899.
[2] Includes establishments distributed as follows: California, 1; Idaho, 1; Illinois, 2; Iowa, 1; Kansas, 2; Nebraska, 1; New Jersey, 2; New Mexico, 1; Texas, 1; Utah, 2; Virginia, 1; Washington, 2.
[3] The amount of this contract work is distributed among the various items to which it properly belongs, and is not, therefore, included in the value of the products as a single item.

# COPPER, SMELTING AND REFINING.

The production of copper in the United States during the year 1899 was the largest in the history of the industry. The rapid increase in production dates from 1879, when the annual product amounted to 23,000 long tons. It increased to 101,239 long tons in 1889 and 269,016 long tons in 1899. The magnitude of the industry in 1899 is indicated by the statistics given in Table 14, which shows the totals for the United States and for each State and Territory in which there were three or more establishments during that year.

TABLE 14.—COPPER, SMELTING AND REFINING: SUMMARY FOR THE UNITED STATES, 1900.[1]

| | United States. | Arizona. | California. | Colorado. | Michigan. | Montana. | New Jersey. | All other states and territories.[2] |
|---|---|---|---|---|---|---|---|---|
| Number of establishments | 47 | 9 | 3 | 3 | 3 | 7 | 7 | 15 |
| Capital: | | | | | | | | |
| Total | $53,063,395 | $7,265,659 | $1,114,882 | $2,308,309 | $1,523,407 | $26,824,298 | $6,943,886 | $7,082,954 |
| Land | $2,091,415 | $122,266 | $11,500 | $99,998 | $35,000 | $309,346 | $854,154 | $659,151 |
| Buildings | $15,670,959 | $965,024 | $278,734 | $623,885 | $1,096,107 | $9,195,526 | $1,568,545 | $1,943,188 |
| Machinery, tools, and implements | $5,771,389 | $515 937 | $131,845 | $429,238 | $196,307 | $2,349,499 | $970,991 | $1,177,572 |
| Cash and sundries | $29,529,632 | $5,662,432 | $692,803 | $1,155,188 | $195,993 | $14,969,927 | $3,550,196 | $3,303,093 |
| Salaried officials, clerks, etc., number | 488 | 80 | 21 | 30 | 17 | 107 | 74 | 159 |
| Salaries | $954,905 | $140,621 | $25,357 | $59,765 | $25,500 | $233,711 | $138,728 | $331,223 |
| Wage-earners, average number | 11,324 | 1,648 | 381 | 410 | 462 | 4,290 | 1,707 | 2,426 |
| Total wages | $8,529,021 | $1,276,739 | $342,491 | $315,958 | $364,647 | $3,791,983 | $915,112 | $1,522,091 |
| Miscellaneous expenses | $1,522,325 | $266,548 | $90,026 | $11,547 | $33,685 | $556,852 | $290,423 | $273,244 |
| Cost of materials used | $122,174,129 | $6,870,884 | $1,379,423 | $3,385,113 | $16,754,220 | $20,556,336 | $32,545,179 | $41,182,974 |
| Value of products | $165,131,670 | $17,286,517 | $4,508,259 | $3,893,034 | $17,340,041 | $36,387,063 | $38,365,131 | $47,351,625 |

[1] This report is for the calendar year 1899.
[2] Includes establishments distributed as follows: Connecticut, 2; Illinois, 1; Maryland, 1; Nevada, 1; New Mexico, 1; New York, 2; Ohio, 1; South Dakota, 1; Tennessee, 1; Utah, 2; Virginia, 1; Washington, 1.

In addition to the 47 active establishments shown in the foregoing table, there were 9 idle establishments with a capital of $371,320—4 located in Arizona, 1 in California, 1 in Illinois, and 3 in Nevada. The statistics given in Table 14 include all establishments engaged in the smelting or refining of copper, but, as in the case of lead smelting or refining, the product of the precious metals in some of these establishments exceeds in value the copper product. In connection with the smelting of copper, 25 establishments smelted 8,866,472 fine ounces of silver and 23 smelted 300,914 fine ounces of gold. Of the refineries, 11 reported a product of 13,229,911 fine ounces of silver and 10 a product of 224,352 fine ounces of gold. The total value of the gold and silver reported by the 47 establishments was $23,257,961, being 14.1 per cent of $165,131,670, the aggregate value of all products. The aggregate value of products is the sum of the products of the smelters and refineries, respectively. The two branches of the industry are conducted almost entirely by independent plants, but the products of the smelters, which, as shown in Table 24, were valued at $54,275,173, are largely sold to the refineries as material, and are therefore largely duplicated in the $107,635,247 given in the same table as the value of the products of the refineries. Under these conditions, the products of the refineries may be accepted as the finished products of the industry; particularly is this the case since the Michigan ore, not being smelted, first appears in this report as a product of the refining plant.

Large quantities of ore are smelted, and large quantities of metal are refined on contract. It appears from Table 26 that the smelters and refineries received $293,961 and $3,452,855, respectively, for this class of work. While in such cases the ore or metal is not purchased nor the finished product owned by the establishments doing the work, nevertheless it is necessary to report the quantities and cost of both in order to ascertain the total quantities and cost of ore and base metal treated and of finished products manufactured in the United States. Therefore all establishments were required to report the total quantities and cost of all materials that passed through the respective plants, and the total quantities and values of all their products, irrespective of the ownership. Establishments doing contract work were also required to report the amount received for such work, and these amounts are shown as separate items under products in Table 26.

While the industry has made rapid progress during the past twenty years, the statistics concerning capital, employees, wages, and products shown in the reports on mineral industries at the censuses of 1880 and 1890 are so meager that they can not be used for comparison with those for 1900.

Table 15 shows the totals for the industry as reported at the census of 1890.

TABLE 15.—STATISTICS OF COPPER, SMELTING AND REFINING: 1889.

| | |
|---|---|
| Capital, total | $4,037,593 |
| Land | 634,000 |
| Buildings and fixtures | 1,758,856 |
| Tools, implements, etc | 600,214 |
| Cash, etc | 1,044,523 |
| Expenditures, total | 1,885,261 |
| Wages | 800,484 |
| Salaries | 71,720 |
| Paid contractors | 19,591 |
| Supplies and materials | 787,098 |
| Rent, interest, insurance, taxes, etc | 256,368 |

In the absence of other trustworthy data, the quantity of copper produced must be accepted as indicating the extent of the increase in the industry. Table 16, taken from the report of the Geological Survey on "The Production of Copper in 1899," shows the quantity of copper produced in each year from 1845 to 1899, inclusive.

TABLE 16.—PRODUCTION OF COPPER IN THE UNITED STATES FROM 1845 TO 1899.

| YEAR. | Total production, United States. | Lake Superior. | Percentage of Lake Superior of total product. | YEAR. | Total production, United States. | Lake Superior. | Percentage of Lake Superior of total product. |
|---|---|---|---|---|---|---|---|
| | *Long tons.* | *Long tons.* | | | *Long tons.* | *Long tons.* | |
| 1845 | 100 | 12 | 12.0 | 1863 | 8,500 | 5,797 | 68.2 |
| 1846 | 150 | 26 | 17.3 | 1864 | 8,000 | 5,576 | 69.7 |
| 1847 | 300 | 213 | 71.0 | 1865 | 8,500 | 6,410 | 75.4 |
| 1848 | 500 | 461 | 92.2 | 1866 | 8,900 | 6,138 | 69.0 |
| 1849 | 700 | 672 | 96.0 | 1867 | 10,000 | 7,824 | 78.2 |
| 1850 | 650 | 572 | 88.0 | 1868 | 11,600 | 9,346 | 80.6 |
| 1851 | 900 | 779 | 86.6 | 1869 | 12,500 | 11,886 | 95.1 |
| 1852 | 1,100 | 792 | 72.0 | 1870 | 12,600 | 10,992 | 87.2 |
| 1853 | 2,000 | 1,297 | 64.9 | 1871 | 13,000 | 11,942 | 91.9 |
| 1854 | 2,250 | 1,819 | 80.8 | 1872 | 12,500 | 10,961 | 87.7 |
| 1855 | 3,000 | 2,593 | 86.4 | 1873 | 15,500 | 13,433 | 86.7 |
| 1856 | 4,000 | 3,666 | 91.7 | 1874 | 17,500 | 15,327 | 87.6 |
| 1857 | 4,800 | 4,255 | 88.6 | 1875 | 18,000 | 16,089 | 89.4 |
| 1858 | 5,500 | 4,088 | 74.3 | 1876 | 19,000 | 17,085 | 89.9 |
| 1859 | 6,300 | 3,985 | 63.3 | 1877 | 21,000 | 17,422 | 83.0 |
| 1860 | 7,200 | 5,388 | 74.8 | 1878 | 21,500 | 17,719 | 82.4 |
| 1861 | 7,500 | 6,713 | 89.5 | 1879 | 23,000 | 19,129 | 83.2 |
| 1862 | 9,000 | 6,065 | 67.4 | 1880 | 27,000 | 22,204 | 82.2 |

TABLE 16.—PRODUCTION OF COPPER IN THE UNITED STATES FROM 1845 TO 1899—Continued.

| YEAR. | Total production, United States. | Lake Superior. | Percentage of Lake Superior of total product. | Montana. | Percentage of Montana of total product. | Arizona. | Percentage of Arizona of total product. | YEAR. | Total production, United States. | Lake Superior. | Percentage of Lake Superior of total product. | Montana. | Percentage of Montana of total product. | Arizona. | Percentage of Arizona of total product. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Long tons.* | *Long tons.* | | *Long tons.* | | *Long tons.* | | | *Long tons.* | *Long tons.* | | *Long tons.* | | *Long tons.* | |
| 1881 | 32,000 | 24,363 | 76.1 | ..... | ..... | ..... | ..... | 1891 | 126,839 | 50,992 | 40.2 | 50,028 | 39.5 | 17,800 | 14.0 |
| 1882 | 40,467 | 25,439 | 62.9 | ..... | ..... | ..... | ..... | 1892 | 154,018 | 54,999 | 35.7 | 72,860 | 47.3 | 17,160 | 11.1 |
| 1883 | 51,574 | 26,653 | 51.6 | 11,011 | 21.3 | 10,658 | 20.7 | 1893 | 147,033 | 50,270 | 34.2 | 69,290 | 47.1 | 19,200 | 13.1 |
| 1884 | 64,708 | 30,961 | 47.8 | 19,256 | 29.8 | 11,935 | 18.4 | 1894 | 158,120 | 51,031 | 32.3 | 81,729 | 51.6 | 19,873 | 12.6 |
| 1885 | 74,052 | 32,209 | 43.5 | 30,267 | 40.9 | 10,137 | 13.7 | 1895 | 169,917 | 57,737 | 34.0 | 84,900 | 50.0 | 21,408 | 12.6 |
| 1886 | 70,430 | 36,124 | 51.3 | 25,362 | 36.0 | 6,990 | 9.9 | 1896 | 205,384 | 64,073 | 31.2 | 99,071 | 48.2 | 32,560 | 15.8 |
| 1887 | 81,017 | 33,941 | 41.9 | 35,133 | 43.4 | 7,910 | 9.7 | 1897 | 220,571 | 64,858 | 29.4 | 102,807 | 46.6 | 36,398 | 16.5 |
| 1888 | 101,054 | 38,604 | 38.2 | 43,704 | 43.2 | 14,195 | 14.0 | 1898 | 235,050 | 66,291 | 28.2 | 92,041 | 39.2 | 49,624 | 21.1 |
| 1889 | 101,239 | 39,364 | 38.7 | 43,849 | 43.3 | 13,654 | 13.5 | 1899 | 253,870 | 65,803 | 25.9 | 100,503 | 39.6 | 59,399 | 23.4 |
| 1890 | 115,966 | 45,273 | 38.9 | 50,437 | 43.5 | 15,534 | 13.4 | | | | | | | | |

As shown in Table 16, the production of copper in the United States during the year 1899, reported to the United States Geological Survey, amounted to 253,870 long tons; this included the copper contents of blue vitriol, and also the copper reported as a by-product of lead smelters. The refined copper product shown in this report as "ingots, wire, bars, etc.," amounts to 602,595,113 pounds, or 269,016 long tons. (See Table 17.) There were also 27,298,926 pounds of blue vitriol reported, and, allowing one-fourth as representing the copper contents, gives 6,824,732 pounds, or 3,047 long tons of copper, making an aggregate product of 272,063 long tons. This, however, includes the copper extracted from imported ores and mattes, while the report of the United States Geological Survey deals only with copper of domestic origin. Practically all of the copper matte reported by the lead smelting works appears as raw material in the returns of the copper refineries.

Prior to 1879 the larger part of the copper product was obtained from the Lake Superior region, but since that date the percentage obtained from that district has been steadily decreasing, although its production has increased more than threefold. The discovery of the rich deposits in Arizona, Montana, and other localities has caused a wider distribution of the industry.

While the location of the establishments engaged in copper smelting is controlled very largely by the source of the ore, still, in many cases, the ore is transported to meet other materials or more favorable conditions for smelting. The products of the smelters are again transported to refineries, which are situated in localities more convenient for securing the materials used in the processes and are in closer touch with the market for the finished products. These conditions have caused a wide distribution of the establishments, and have tended to specialize and localize the two branches of the industry.

Table 17 presents separately the statistics for establishments located east and west of the Mississippi River.

TABLE 17.—COPPER, SMELTING AND REFINING: ESTABLISHMENTS BY LOCATION EAST AND WEST OF THE MISSISSIPPI RIVER, 1900.[1]

| | United States. | East of the Mississippi. | West of the Mississippi. |
|---|---|---|---|
| Number of establishments | 47 | 19 | 28 |
| Capital | $53,068,395 | $13,680,503 | $39,382,892 |
| Salaried officials, clerks, etc., number | 488 | 226 | 262 |
| Salaries | $954,905 | $416,981 | $537,924 |
| Wage-earners, average number | 11,324 | 4,083 | 7,241 |
| Total wages | $8,529,021 | $2,323,370 | $6,205,651 |
| Miscellaneous expenses | $1,522,325 | $551,228 | $971,097 |
| Materials used: | | | |
| Total cost | $122,174,129 | $86,840,595 | $35,333,534 |
| Ores— | | | |
| Tons | 4,030,315 | 139,514 | 3,899,801 |
| Cost | $25,190,522 | $733,622 | $24,456,900 |
| Matte purchased— | | | |
| Tons | 48,182 | 43,954 | 4,228 |
| Cost | $10,513,431 | $9,767,037 | $746,394 |
| Blister or anodes purchased— | | | |
| Tons | 284,020 | 284,020 | |
| Cost | $72,401,654 | $72,401,654 | |
| All other materials | $14,068,522 | $3,938,282 | $10,130,240 |
| Products: | | | |
| Aggregate value | $165,131,670 | $97,832,016 | $67,299,654 |
| Smelting— | | | |
| Total value | $54,275,173 | $1,140,140 | $53,135,033 |
| Fine copper contents of blister or anodes— | | | |
| Pounds | 197,056,734 | 2,930,000 | 194,126,734 |
| Value | $25,853,917 | $440,000 | $25,413,917 |
| Fine copper contents of matte— | | | |
| Pounds | 137,622,709 | 3,640,418 | 133,982,291 |
| Value | $17,511,130 | $458,462 | $17,052,668 |
| Silver— | | | |
| Fine ounces | 8,866,472 | 305,487 | 8,560,985 |
| Value | $5,020,050 | $172,033 | $4,848,017 |
| Gold— | | | |
| Fine ounces | 300,914 | 3,486 | 297,428 |
| Value | $5,890,076 | $69,645 | $5,820,431 |
| Refining— | | | |
| Total value | $107,635,247 | $93,470,626 | $14,164,621 |
| Ingots, wire, bars, etc.— | | | |
| Pounds | 602,595,113 | 507,190,645 | 95,404,468 |
| Value | $94,061,667 | $81,871,103 | $12,190,564 |
| Blue vitriol— | | | |
| Pounds | 27,298,926 | 26,017,613 | 1,281,313 |
| Value | $1,225,745 | $1,178,208 | $47,537 |
| Silver— | | | |
| Fine ounces | 13,229,911 | 10,203,023 | 3,026,888 |
| Value | $7,790,985 | $6,076,707 | $1,714,278 |
| Gold— | | | |
| Fine ounces | 224,352 | 213,740 | 10,612 |
| Value | $4,556,850 | $4,344,608 | $212,242 |
| All other products, value | $3,221,250 | $3,221,250 | |

[1] This report is for the calendar year 1899.

Table 17 shows that 28 of the 47 establishments engaged in the industry are located west of the Mississippi and that their product was valued at $67,299,654, or 40.8 per cent of the total. All the establishments west of the Mississippi were engaged in smelting, 25 of them in smelting exclusively, and 3 in both smelting and refining, their proximity to the source of the ore resulting in the development of this branch of the industry. Their smelting product amounted to $53,135,033, or 97.9 per cent of the $54,275,173 reported as the product of all smelters. The fine copper contents of the blister and matte reported by the establishments in the Western states amounted to 328,109,025 pounds, or 98 per cent of the total.

While the smelting industry is largely confined to the establishments located in the Western states, the refining is peculiar to the establishments in the Eastern states. Of the 19 establishments east of the Mississippi, 16 were refineries and their product amounted to $93,470,626, or 86.8 per cent of the $107,635,247 reported as the product of all refining. There were 7 refineries located in the state of New Jersey, their refined product, not including by-products, amounting to $35,149,583, or 32.7 per cent of the total product of refineries. Montana was the only Western state in which ingots, wire, bars, and finished refined products were made, the product of the state amounting to 95,404,468 pounds. The remaining 507,190,645 pounds of refined copper were manufactured in the Eastern states.

Michigan appears in the tables with only a part of the product of the Lake Superior district, since a considerable part of the native copper or "mineral" produced is shipped East for refining. The statistics of the stamp mills and concentrating plants of Lake Superior are not included in this investigation. It is a fact, however, that the native copper produced by the Lake Superior mines goes almost entirely to a number of refineries which treat no other copper material. Segregating these, we have the following statistics:

*Refining Lake Superior mineral.*

| | |
|---|---|
| Expenditures: | |
| Wages | $475,501 |
| Superintendence | 49,703 |
| Fuel | 163,843 |
| Supplies and materials, not including cost of "mineral" | 195,364 |
| Rent, interest, insurance, etc | 49,368 |
| Total | 933,779 |
| "Mineral" treated, short tons | 121,243 |
| Refined copper product, pounds | 157,940,824 |

The foregoing statistics show the average expenditure per pound of refined copper to be 0.591 of a cent.

In recent years the increasing utilization by concentration of the finer slimes of the stamp mills has led to the production of lower grades of "mineral." This is reflected in the statistics, which show that the mineral treated by the refineries averaged 65.1 per cent of copper.

Table 18 shows the quantities and cost of the ore, matte, and blister or anodes used as material, and the number of establishments reporting each.

TABLE 18.—QUANTITIES AND COST OF MATERIALS USED, AND NUMBER OF ESTABLISHMENTS REPORTING EACH CLASS: 1900.[1]

| CLASS. | Number of establishments reporting. | Tons. | Cost. |
|---|---|---|---|
| Total cost | | | $122,174,129 |
| Ores | 33 | 4,039,315 | 25,190,522 |
| Matte (purchased) | 11 | 48,182 | 10,513,431 |
| Blister or anodes (purchased) | 13 | 284,020 | 72,401,654 |
| All other materials, including fuel, mill supplies, etc | | | 14,068,522 |

[1] This report is for the calendar year 1899.

As previously explained, the quantities and cost shown in Table 18 include the materials worked on contract, for which class of work $3,746,816 was received.

Of the 47 establishments engaged in the industry 33 reported the consumption of 4,039,315 long tons of ores, valued at $25,190,522; 11 reported that they purchased 48,182 long tons of matte, valued at $10,513,431; and 13, the purchase of 284,020 long tons of blister or anodes, valued at $72,401,654. In cases where matte and blister or anodes were manufactured as an intermediate product and consumed in the same establishment, its quantity or value was not ascertained. The matte and blister or anodes shown in Table 18 represent the quantities and value of these classes of materials purchased by the establishments consuming them, or which were refined on contract.

In the preceding tables, states in which there were less than 3 establishments have been grouped so as to avoid disclosing the operations of individual establishments. Table 19 shows the quantities of materials used in each of the states and territories irrespective of the number of establishments.

TABLE 19.—MATERIALS USED, BY STATES: 1900.[1]

| STATES AND TERRITORIES. | Ores. | Matte purchased. | Blister or anodes purchased. |
|---|---|---|---|
| United States | *Tons.* 4,039,315 | *Tons.* 48,182 | *Tons.* 284,020 |
| Arizona | 752,642 | 1,413 | |
| California | 223,251 | 20 | |
| Colorado | 159,729 | | |
| Connecticut | | 824 | 14,745 |
| Illinois | | 2,400 | |
| Maryland | | 32 | 75,165 |
| Michigan | | | 83,852 |
| Montana | 2,442,636 | 2,795 | |
| Nevada | 19,071 | | |
| New Jersey | 3,706 | 29,778 | 72,867 |
| New Mexico | 23,048 | | |
| New York | 45,000 | 10,920 | 37,391 |
| Ohio | | | |
| South Dakota | 124,132 | | |
| Tennessee | 85,723 | | |
| Utah | 65,292 | | |
| Virginia | 5,025 | | |
| Washington | 90,000 | | |

[1] This report is for the calendar year 1899.

The large consumption of ore in the Western states is of course due to the proximity of the mines; the quantity used in these states amounted to 3,899,801 long tons, or 96.5 per cent of the total. The greater part of the ores used in the Eastern states is imported. The smelters in the state of Montana reported 2,442,636 long tons of ores, or 60.5 per cent of the total of all ores treated. The smelters in Arizona rank second in the quantity of ore consumed, reporting 752,642 long tons. California, with 223,251 long tons, ranks third; Colorado, with 159,729 long tons, fourth; and South Dakota, with 124,132 long tons, fifth, a considerable part of the ore of the latter state having been drawn from Montana. The refineries located in New Jersey, Michigan, Maryland, and New York are, in the order named, the largest consumers of matte and blister.

There were 26 establishments which reported ore and 13 which reported matte and blister or anodes as the only component materials used during the census year. The remaining 8 establishments used both classes of materials.

Table 20 shows the statistics for the 47 establishments arranged in these 3 groups.

TABLE 20.—ESTABLISHMENTS CLASSIFIED ACCORDING TO MATERIALS USED: 1900.[1]

| | All establishments. | Using ores only. | Using matte and blister or anodes only. | All other establishments. |
|---|---|---|---|---|
| Number of establishments | 47 | 26 | 13 | 8 |
| Capital | $53,063,395 | $35,973,221 | $9,282,105 | $7,858,069 |
| Salaried officials, clerks, etc., number | 488 | 239 | 124 | 125 |
| Salaries | $954,905 | $494,695 | $211,031 | $249,179 |
| Wage-earners, average number | 11,324 | 6,399 | 2,344 | 2,581 |
| Total wages | $8,529,021 | $5,586,784 | $1,393,006 | $1,549,231 |
| Miscellaneous expenses | $1,522,325 | $988,139 | $192,272 | $391,914 |
| Materials used: | | | | |
| Total cost | $122,174,129 | $32,028,770 | $74,103,544 | $16,041,815 |
| Ores— | | | | |
| Tons | 4,039,315 | 3,699,879 | | 339,436 |
| Cost | $25,190,522 | $22,858,610 | | $2,331,912 |
| Matte and blister or anodes— | | | | |
| Tons | 332,202 | | 282,850 | 49,352 |
| Cost | $82,915,085 | | $72,300,591 | $10,614,494 |
| All other materials | $14,068,522 | $9,170,160 | $1,802,953 | $3,095,409 |

[1] This report is for the calendar year 1899.

TABLE 20.—ESTABLISHMENTS CLASSIFIED ACCORDING TO MATERIALS USED: 1900—Continued.[1]

| | All establishments. | Using ores only. | Using matte and blister or anodes only. | All other establishments. |
|---|---|---|---|---|
| Products: | | | | |
| Aggregate value | $165,131,670 | $58,892,793 | $82,438,564 | $23,800,313 |
| Smelting— | | | | |
| Total value | $54,275,173 | $44,775,709 | ..... | $9,499,464 |
| Fine copper contents of blister or anodes— | | | | |
| Pounds | 197,056,784 | 145,436,875 | ..... | 51,619,859 |
| Value | $25,853,917 | $18,774,901 | ..... | $7,079,016 |
| Fine copper contents of matte— | | | | |
| Pounds | 137,622,709 | 126,178,705 | ..... | 11,444,004 |
| Value | $17,511,180 | $15,906,544 | ..... | $1,604,636 |
| Silver— | | | | |
| Fine ounces | 8,866,472 | 7,906,717 | ..... | 959,755 |
| Value | $5,020,050 | $4,456,251 | ..... | $563,799 |
| Gold— | | | | |
| Fine ounces | 300,914 | 281,981 | ..... | 18,933 |
| Value | $5,890,076 | $5,638,013 | ..... | $252,063 |
| Refining— | | | | |
| Total value | $107,635,247 | $14,117,084 | $80,890,954 | $12,627,209 |
| Ingots, wire, bars, etc.— | | | | |
| Pounds | 602,595,113 | 95,404,468 | 442,307,615 | 64,883,030 |
| Value | $94,061,667 | $12,190,564 | $71,652,928 | $10,218,175 |
| Blue vitriol— | | | | |
| Pounds | 27,298,926 | ..... | 13,017,613 | 14,281,313 |
| Value | $1,225,745 | ..... | $578,208 | $647,537 |
| Silver— | | | | |
| Fine ounces | 13,229,911 | 3,026,888 | 9,555,948 | 647,075 |
| Value | $7,790,985 | $1,714,278 | $5,688,470 | $388,237 |
| Gold— | | | | |
| Fine ounces | 224,352 | 10,612 | 145,066 | 68,674 |
| Value | $4,556,850 | $212,242 | $2,971,348 | $1,373,260 |
| All other products, value | $3,221,250 | ..... | $1,547,610 | $1,673,640 |

[1] This report is for the calendar year 1899.

Of the 26 establishments shown in Table 20 which used ore only as the component material, 24 were engaged exclusively in smelting and 2 in smelting and refining. The 26 establishments consumed 3,699,879 long tons of ores, and their products consisted of 42,591 long tons of refined copper, 121,257 long tons copper contents of matte and blister or anodes, 10,933,605 fine ounces of silver, and 292,593 fine ounces of gold.

The 13 establishments using only matte and blister or anodes as their raw materials were engaged in refining exclusively. They consumed 282,850 long tons of material and their product amounted to 203,270 long tons of refined copper and blue vitriol.

While, for the reasons given in the general discussion of the statistics of manufactures, the difference between the sum of the expenditures for salaries, wages, miscellaneous expenses, and materials and the value of the products can not be accepted as showing the profit or loss in the business, the totals given in Table 20 may be used to ascertain the proportions which the different items of expenditure are of the total expenses in the establishments using respectively ore only, or matte and blister only, or both classes of material. Table 21 shows each item of cost and the percentage which it forms of the total cost for each of the classes of establishments.

TABLE 21.—SALARIES, WAGES, MISCELLANEOUS EXPENSES, AND MATERIALS FOR ESTABLISHMENTS CLASSIFIED ACCORDING TO MATERIALS USED: 1900.[1]

| | ALL ESTABLISHMENTS. | | USING ORES ONLY. | | USING MATTE AND BLISTER OR ANODES ONLY. | | ALL OTHER ESTABLISHMENTS. | |
|---|---|---|---|---|---|---|---|---|
| | Amount. | Per cent of total. | Amount. | Per cent of total. | Amount. | Per cent of total. | Amount. | Per cent of total. |
| Total | $133,180,380 | 100.0 | $39,048,388 | 100.0 | $75,899,853 | 100.0 | $18,232,139 | 100.0 |
| Salaries | 954,905 | 0.7 | 494,695 | 1.3 | 211,031 | 0.3 | 249,179 | 1.4 |
| Wages | 8,529,021 | 6.4 | 5,586,784 | 14.3 | 1,393,006 | 1.8 | 1,549,231 | 8.5 |
| Miscellaneous expenses | 1,522,325 | 1.2 | 938,139 | 2.4 | 192,272 | 0.3 | 391,914 | 2.1 |
| Materials | 122,174,129 | 91.7 | 32,028,770 | 82.0 | 74,103,544 | 97.6 | 16,041,815 | 88.0 |

[1] This report is for the calendar year 1899.

As previously explained, the aggregate value of products, $165,131,670, consists of the products of both smelters and refineries. Table 22 separates these two classes of products, showing the quantities and values of each, and also the number of establishments manufacturing each.

TABLE 22.—QUANTITIES AND VALUE OF PRODUCTS: 1900.[1]

| CLASS. | Number of establishments reporting. | PRODUCTS. | | |
|---|---|---|---|---|
| | | Unit of measure. | Quantities. | Value. |
| Aggregate value | | | | $165,131,670 |
| Smelting: | | | | |
| Total value | | | | 54,275,173 |
| Fine copper contents of blister or anodes | 15 | Pound... | 197,056,734 | 25,353,917 |
| Fine copper contents of matte | 21 | Pound... | 137,622,709 | 17,511,130 |
| Silver | 25 | Oz. fine.. | 8,866,472 | 5,020,050 |
| Gold | 23 | Oz. fine.. | 300,914 | 5,890,076 |
| Refining: | | | | |
| Total value | | | | 107,635,247 |
| Ingots, wire, bars, etc. | 18 | Pound... | 602,595,113 | 94,061,667 |
| Blue vitriol | 7 | Pound... | 27,298,926 | 1,225,745 |
| Silver | 11 | Oz. fine.. | 13,229,911 | 7,790,985 |
| Gold | 10 | Oz. fine.. | 224,352 | 4,556,850 |
| All other products | | | | 3,221,250 |

[1] This report is for the calendar year 1899.

The fine copper contents of blister and matte shown in Table 22 is the quantity manufactured for sale, and does not include the quantity manufactured as an intermediate product. Of the 47 establishments, 15 manufactured blister or anodes and 21 matte for sale. By reference to Table 18, it appears that 13 establishments purchased blister or anodes and 11 purchased matte as material. No comparisons, however, can be made between the quantities of these ingredients manufactured for sale and the quantities purchased, because the purchases may be the products of preceding years, and while the total weight is reported for the quantities purchased as material, the copper contents only are given for the quantities sold as product. Silver was a product of 25 and gold of 23 smelters. Of the refineries, it appears that only 18 manufactured a finished copper product, 7 made blue vitriol, 11 refined silver, and 10 refined gold.

Table 23 shows the quantities of each product for both branches of the industry in each state and territory, irrespective of the number of establishments engaged in its manufacture.

TABLE 23.—PRODUCTS BY STATES: 1900.[1]

| STATES AND TERRITORIES. | SMELTING. | | | | REFINING. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fine copper contents of blister or anodes. | Fine copper contents of matte. | Silver. | Gold. | Ingots, wire, bars, etc. | Blue vitriol. | Silver. | Gold. |
| United States | *Pounds.* 197,056,734 | *Pounds.* 137,622,709 | *Oz. fine.* 8,866,472 | *Oz. fine.* 300,914 | *Pounds.* 602,595,113 | *Pounds.* 27,298,926 | *Oz. fine.* 13,229,911 | *Oz. fine.* 224,352 |
| Arizona | 75,127,116 | 52,832,952 | 711,373 | 18,074 | ..... | 1,281,313 | ..... | ..... |
| California | 84,000 | 25,863,637 | 427,315 | 23,328 | ..... | ..... | ..... | ..... |
| Connecticut | ..... | ..... | ..... | ..... | 29,950,425 | ..... | ..... | ..... |
| Colorado | ..... | 21,212,797 | 728,334 | 71,396 | ..... | ..... | ..... | ..... |
| Illinois | ..... | ..... | ..... | ..... | 4,517,647 | ..... | ..... | ..... |
| Maryland | ..... | ..... | ..... | ..... | 133,619,824 | 11,199,341 | 2,308,582 | 11,788 |
| Michigan | ..... | ..... | ..... | ..... | 102,001,189 | ..... | ..... | ..... |
| Montana | 112,775,861 | 24,492,199 | 6,032,031 | 45,781 | 95,404,468 | ..... | 3,026,888 | 10,012 |
| Nevada | ..... | 536,075 | 30,985 | 249 | ..... | ..... | ..... | ..... |
| New Jersey | 2,930,000 | ..... | 301,800 | 3,453 | 170,326,925 | 1,818,272 | 7,594,285 | 150,949 |
| New Mexico | ..... | 3,869,082 | 125,482 | 6,252 | ..... | ..... | ..... | ..... |
| New York | ..... | ..... | ..... | ..... | 66,774,635 | 13,000,000 | 300,156 | 51,003 |
| Ohio | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| South Dakota | ..... | 2,175,549 | 317,263 | 84,723 | ..... | ..... | ..... | ..... |
| Tennessee | ..... | 3,408,618 | ..... | ..... | ..... | ..... | ..... | ..... |
| Utah | 6,139,757 | ..... | 88,202 | 7,625 | ..... | ..... | ..... | ..... |
| Virginia | ..... | 231,800 | 3,687 | 33 | ..... | ..... | ..... | ..... |
| Washington | ..... | 3,000,000 | 100,000 | 40,000 | ..... | ..... | ..... | ..... |

[1] This report is for the calendar year 1899.

As shown by Table 23, a refined copper product of ingots, wire, bars, etc., was manufactured in 7 states, the largest product, 170,326,925 pounds, being reported for the state of New Jersey. The 4 Eastern states, Connecticut, Maryland, New Jersey, and New York, produced 400,671,809 pounds, or 66.5 per cent of the total, while the 3 Western states, Illinois, Michigan, and Montana, produced 201,923,304 pounds, or 33.5 per cent of the total. The table shows that 26,017,613 pounds, or 95.3 per cent of the total product, of blue vitriol were manufactured in the 3 Eastern states, Maryland, New Jersey, and New York, the remaining 1,281,313 pounds being reported for Arizona. Table 23 also shows the large quantities of partially finished product, blister or anodes, and matte manufactured in the Western states. This class of products is shown for 12 states and territories, 9 of them being west of the Mississippi River. Of the total, 334,679,443 pounds, reported as the fine copper contents of blister or anodes and matte, 328,109,025 pounds, or 98 per cent, were made in the Western states and 6,570,418 pounds, or 2 per cent, in the Eastern states.

Table 24 presents, separately, the statistics for the 27 establishments engaged exclusively in smelting, the 15 engaged in refining, and the 5 in both processes.

TABLE 24.—ESTABLISHMENTS CLASSIFIED ACCORDING TO PROCESS EMPLOYED: 1900.[1]

| | All establishments. | Smelting only. | Refining only. | Smelting and refining. |
|---|---|---|---|---|
| Number of establishments | 47 | 27 | 15 | 5 |
| Capital | $53,063,395 | $19,375,065 | $12,166,962 | $21,521,368 |
| Salaried officials, clerks, etc., number | 488 | 221 | 180 | 87 |
| Salaries | $954,905 | $435,784 | $335,526 | $183,595 |
| Wage-earners, average number | 11,324 | 4,203 | 3,213 | 3,908 |
| Total wages | $8,529,021 | $3,576,429 | $1,895,705 | $3,056,887 |
| Miscellaneous expenses | $1,522,325 | $621,573 | $388,243 | $512,509 |
| Materials used: | | | | |
| Total cost | $122,174,129 | $18,558,130 | $80,268,059 | $23,347,940 |
| Ores— | | | | |
| Tons | 4,039,315 | 1,893,291 | 48,303 | 2,097,721 |
| Cost | $25,190,522 | $12,340,785 | $477,004 | $12,372,733 |
| Matte and blister or anodes— | | | | |
| Tons | 332,202 | 2,902 | 312,215 | 17,085 |
| Cost | $82,915,085 | $621,393 | $77,713,691 | $4,580,001 |
| All other materials | $14,068,522 | $5,595,952 | $2,077,364 | $6,395,206 |
| Products: | | | | |
| Aggregate value | $165,131,670 | $38,173,276 | $90,168,226 | $36,790,158 |
| Smelting— | | | | |
| Total value | $54,275,173 | $38,173,276 | ..... | $16,101,897 |
| Fine copper contents of blister or anodes— | | | | |
| Pounds | 197,056,734 | 88,263,325 | ..... | 108,793,409 |
| Value | $25,853,917 | $11,623,280 | ..... | $14,230,637 |
| Fine copper contents of matte— | | | | |
| Pounds | 137,622,709 | 137,359,799 | ..... | 262,910 |
| Value | $17,511,130 | $17,472,588 | ..... | $38,542 |
| Silver— | | | | |
| Fine ounces | 8,866,472 | 5,995,892 | ..... | 2,870,580 |
| Value | $5,020,050 | $3,463,235 | ..... | $1,556,815 |
| Gold— | | | | |
| Fine ounces | 300,914 | 287,116 | ..... | 13,798 |
| Value | $5,890,076 | $5,614,173 | ..... | $275,903 |
| Refining— | | | | |
| Total value | $107,635,247 | ..... | $88,620,626 | $19,014,621 |
| Ingots, wire, bars, etc.— | | | | |
| Pounds | 602,595,113 | ..... | 475,930,645 | 126,664,468 |
| Value | $94,061,667 | ..... | $77,021,103 | $17,040,564 |
| Blue vitriol— | | | | |
| Pounds | 27,298,926 | ..... | 26,017,618 | 1,281,313 |
| Value | $1,225,745 | ..... | $1,178,208 | $47,537 |
| Silver— | | | | |
| Fine ounces | 13,229,911 | ..... | 10,203,023 | 3,026,888 |
| Value | $7,790,985 | ..... | $6,076,707 | $1,714,278 |
| Gold— | | | | |
| Fine ounces | 224,352 | ..... | 213,740 | 10,612 |
| Value | $4,556,350 | ..... | $4,344,108 | $212,242 |
| All other products, value | $3,221,250 | ..... | $1,547,610 | $1,673,640 |

[1] This report is for the calendar year 1899.

It appears from Table 24 that of the total capital, $53,063,395, invested in copper smelting and refining, $19,375,065, or 36.5 per cent, was invested in plants devoted exclusively to smelting; $12,166,962, or 22.9 per cent, in plants devoted to refining; and $21,521,368, or 40.6 per cent, in those engaged in both branches of the industry. The average investment per establishment for the three classes, in the order named, is as follows: $717,595, $811,131, and $4,304,274. The average value of products per establishment is as follows: $1,413,825, $6,011,216, and $7,358,032. The largest plants, therefore, are those in which both branches of the industry are carried on.

As previously explained, the items of expense shown in the census reports do not cover all the expenses of the establishments reported, no cognizance being taken of the cost of selling the product, of mercantile losses incurred, or of depreciation in plant; nevertheless, the items reported bear a certain relation to each other and to the total for the United States, according to the branch of the industry in which the establishment is engaged. For instance, in establishments engaged in smelting exclusively the proportional expenditure for labor will be larger and for materials less than in establishments engaged exclusively in refining. Table 25 shows the items of expense and the percentage which each is of the total for the establishments included in each of the 3 groups given in Table 24.

TABLE 25.—SALARIES, WAGES, MISCELLANEOUS EXPENSES, AND MATERIALS FOR ESTABLISHMENTS CLASSIFIED ACCORDING TO PROCESS EMPLOYED: 1900.[1]

| | ALL ESTABLISHMENTS. | | SMELTING. | | REFINING. | | SMELTING AND REFINING. | |
|---|---|---|---|---|---|---|---|---|
| | Amount. | Per cent of total. | Amount. | Per cent of total. | Amount. | Per cent of total. | Amount. | Per cent of total. |
| Total | $133,180,380 | 100.0 | $23,191,916 | 100.0 | $82,887,533 | 100.0 | $27,100,931 | 100.0 |
| Salaries | 954,905 | 0.7 | 435,784 | 1.9 | 335,526 | 0.4 | 183,595 | 0.7 |
| Wages | 8,529,021 | 6.4 | 3,576,429 | 15.4 | 1,895,705 | 2.3 | 3,056,887 | 11.3 |
| Miscellaneous expenses | 1,522,325 | 1.2 | 621,573 | 2.7 | 388,243 | 0.5 | 512,509 | 1.9 |
| Materials | 122,174,129 | 91.7 | 18,558,130 | 80.0 | 80,268,059 | 96.8 | 23,347,940 | 86.2 |

[1] This report is for the calendar year 1899.

The detailed statistics for the industry as reported at the census of 1900 are shown in Table 26. This table presents separate totals for each state in which there were 3 or more establishments, and groups the statistics for other states, so as not to disclose the operations of individual establishments. The establishments are also classified according to ownership, which shows that 2 were owned by individuals, 3 by firms or partnerships, and 42 by corporations. The employees are classified so as to show for salaried officials and wage-earners separately the number, salaries, and wages of men, women, and children, respectively, and also the average number of wage-earners employed during each month of the year. Separate totals are shown for the different materials and products of smelting and refining, respectively, and also the amounts received for contract work on the different classes of products, but, as previously explained, the quantities and values of the ores smelted or refined on contract are included in the quantities and values of the materials and products. The number of engines, water wheels, etc., and their horsepower are presented, and the 47 establishments are grouped according to the number of employees in each.

TABLE 26.—COPPER, SMELTING AND REFINING, BY STATES AND TERRITORIES: 1900.[1]

| | United States. | Arizona. | California. | Colorado. | Michigan. | Montana. | New Jersey. | All other states and territories.[2] |
|---|---|---|---|---|---|---|---|---|
| Number of establishments | 47 | 9 | 3 | 3 | 3 | 7 | 7 | 15 |
| Character of organization: | | | | | | | | |
| Individual | 1 | | | | | | | 1 |
| Firm and limited partnership | 3 | 1 | 1 | | | | 1 | |
| Incorporated company | 43 | 8 | 2 | 3 | 3 | 7 | 6 | 14 |
| Capital: | | | | | | | | |
| Total | $53,063,395 | $7,265,659 | $1,114,882 | $2,308,309 | $1,523,407 | $26,824,298 | $6,943,886 | $7,082,954 |
| Land | $2,091,415 | $122,206 | $11,500 | $99,998 | $35,000 | $309,346 | $854,154 | $659,151 |
| Buildings | $15,670,959 | $965,024 | $278,734 | $623,885 | $1,096,107 | $9,195,526 | $1,568,545 | $1,943,138 |
| Machinery, tools, and implements | $5,771,389 | $515,937 | $131,845 | $429,238 | $196,307 | $2,349,499 | $970,991 | $1,177,572 |
| Cash and sundries | $29,529,632 | $5,662,432 | $692,803 | $1,155,188 | $195,993 | $14,969,927 | $3,550,196 | $3,303,093 |
| Proprietors and firm members | 4 | | | | 1 | | 2 | 1 |
| Salaried officials, clerks, etc.: | | | | | | | | |
| Total number | 488 | 80 | 21 | 30 | 17 | 107 | 74 | 159 |
| Total salaries | $954,905 | $140,621 | $25,357 | $59,765 | $25,500 | $283,711 | $138,728 | $331,223 |
| Officers of corporations— | | | | | | | | |
| Number | 64 | 19 | 3 | 3 | | 7 | 10 | 22 |
| Salaries | $308,975 | $38,283 | $1,490 | $7,700 | | $69,500 | $60,880 | $131,122 |
| General superintendents, managers, clerks, etc.— | | | | | | | | |
| Total number | 424 | 61 | 18 | 27 | 17 | 100 | 64 | 137 |
| Total salaries | $645,930 | $102,338 | $23,867 | $52,065 | $25,500 | $164,211 | $77,848 | $200,101 |
| Men— | | | | | | | | |
| Number | 410 | 61 | 18 | 27 | 17 | 95 | 61 | 131 |
| Salaries | $632,118 | $102,338 | $23,867 | $52,065 | $25,500 | $159,531 | $75,868 | $192,949 |
| Women— | | | | | | | | |
| Number | 14 | | | | | 5 | 3 | 6 |
| Salaries | $13,812 | | | | | $4,680 | $1,980 | $7,152 |
| Wage-earners, including pieceworkers, and total wages: | | | | | | | | |
| Greatest number employed at any one time during the year | 13,624 | 1,988 | 447 | 486 | 514 | 5,303 | 2,103 | 2,783 |
| Least number employed at any one time during the year | 9,527 | 1,404 | 335 | 320 | 410 | 3,602 | 1,275 | 2,181 |
| Average number | 11,324 | 1,648 | 381 | 410 | 462 | 4,290 | 1,707 | 2,426 |
| Wages | $8,529,021 | $1,276,739 | $342,491 | $315,958 | $364,647 | $3,791,983 | $915,112 | $1,522,091 |
| Men, 16 years and over— | | | | | | | | |
| Average number | 11,272 | 1,648 | 381 | 410 | 462 | 4,258 | 1,705 | 2,408 |
| Wages | $8,509,895 | $1,276,739 | $342,491 | $315,958 | $364,647 | $3,777,328 | $914,812 | $1,517,920 |
| Women, 16 years and over— | | | | | | | | |
| Average number | 4 | | | | | 4 | | |
| Wages | $2,500 | | | | | $2,500 | | |
| Children, under 16 years— | | | | | | | | |
| Average number | 48 | | | | | 28 | 2 | 18 |
| Wages | $16,626 | | | | | $12,155 | $800 | $4,171 |
| Average number of wage-earners, including pieceworkers, employed during each month: | | | | | | | | |
| Men, 16 years and over— | | | | | | | | |
| January | 10,785 | 1,632 | 370 | 422 | 469 | 4,148 | 1,338 | 2,356 |
| February | 10,591 | 1,637 | 429 | 411 | 445 | 4,004 | 1,349 | 2,316 |
| March | 10,794 | 1,669 | 377 | 434 | 446 | 4,049 | 1,477 | 2,342 |
| April | 10,444 | 1,612 | 379 | 341 | 450 | 3,814 | 1,592 | 2,256 |
| May | 11,492 | 1,748 | 344 | 344 | 429 | 4,520 | 1,631 | 2,476 |
| June | 11,530 | 1,743 | 341 | 241 | 430 | 4,685 | 1,716 | 2,424 |
| July | 11,202 | 1,699 | 341 | 440 | 452 | 4,143 | 1,778 | 2,354 |
| August | 11,470 | 1,619 | 352 | 441 | 465 | 4,340 | 1,871 | 2,382 |
| September | 11,559 | 1,607 | 398 | 482 | 479 | 4,301 | 1,860 | 2,432 |
| October | 11,696 | 1,633 | 409 | 455 | 505 | 4,223 | 1,908 | 2,568 |
| November | 11,746 | 1,554 | 446 | 457 | 493 | 4,410 | 1,932 | 2,454 |
| December | 12,005 | 1,618 | 384 | 456 | 482 | 4,511 | 2,013 | 2,541 |
| Women, 16 years and over— | | | | | | | | |
| January | 4 | | | | | 4 | | |
| February | 4 | | | | | 4 | | |
| March | 4 | | | | | 4 | | |
| April | 4 | | | | | 4 | | |
| May | 4 | | | | | 4 | | |
| June | 4 | | | | | 4 | | |
| July | 4 | | | | | 4 | | |
| August | 4 | | | | | 4 | | |
| September | 4 | | | | | 4 | | |
| October | 5 | | | | | 5 | | |
| November | 4 | | | | | 4 | | |
| December | 3 | | | | | 3 | | |

[1] This report is for the calendar year 1899.

[2] Includes establishments distributed as follows: Connecticut, 2; Illinois, 1; Maryland, 1; Nevada, 1; New Mexico, 1; New York, 2; Ohio, 1; South Dakota, 1; Tennessee, 1; Utah, 2; Virginia, 1; Washington, 1.

TABLE 26.—COPPER, SMELTING AND REFINING, BY STATES AND TERRITORIES: 1900—Continued.[1]

| | United States. | Arizona. | California. | Colorado. | Michigan. | Montana. | New Jersey. | All other states and territories.[2] |
|---|---|---|---|---|---|---|---|---|
| Average number of wage-earners, including pieceworkers, employed during each month—Continued. | | | | | | | | |
| Children, under 16 years— | | | | | | | | |
| January | 50 | | | | | 28 | | 22 |
| February | 47 | | | | | 26 | | 21 |
| March | 51 | | | | | 29 | | 22 |
| April | 42 | | | | | 22 | | 20 |
| May | 50 | | | | | 29 | | 21 |
| June | 47 | | | | | 28 | | 19 |
| July | 52 | | | | | 32 | 3 | 17 |
| August | 48 | | | | | 28 | 3 | 17 |
| September | 48 | | | | | 28 | 3 | 17 |
| October | 45 | | | | | 25 | 3 | 17 |
| November | 54 | | | | | 37 | 3 | 14 |
| December | 42 | | | | | 26 | 3 | 13 |
| Miscellaneous expenses: | | | | | | | | |
| Total | $1,522,325 | $266,548 | $90,026 | $11,547 | $33,685 | $556,852 | $290,423 | $273,244 |
| Rent of works | $32,900 | | | | | $25,000 | $1,500 | $6,400 |
| Taxes, not including internal revenue | $215,242 | $30,036 | $4,229 | $6,878 | $6,705 | $128,005 | $10,080 | $29,309 |
| Rent of offices, insurance, interest, and all sundry expenses not hitherto included | $1,228,603 | $236,512 | $85,797 | $3,991 | $26,980 | $388,945 | $248,843 | $237,535 |
| Contract work | $45,580 | | | $678 | | $14,902 | $30,000 | |
| Materials used: | | | | | | | | |
| Total cost | $122,174,129 | $6,370,884 | $1,379,423 | $3,385,113 | $16,754,220 | $20,556,336 | $32,545,170 | $41,182,974 |
| Ores— | | | | | | | | |
| Tons | 4,039,315 | 752,642 | 223,251 | 159,729 | | 2,442,636 | 3,766 | 457,291 |
| Cost | $25,190,522 | $3,426,054 | $778,452 | $3,070,825 | | $14,458,398 | $127,004 | $3,329,789 |
| Matte purchased— | | | | | | | | |
| Tons | 48,182 | 1,413 | 20 | | | 2,795 | 29,778 | 14,176 |
| Cost | $10,513,481 | $130,935 | $3,625 | | | $611,834 | $6,706,875 | $3,060,162 |
| Blister "mineral" or anodes purchased— | | | | | | | | |
| Tons | 284,020 | | | | 83,852 | | 72,867 | 127,301 |
| Cost | $72,401,654 | | | | $16,501,529 | | $22,796,489 | $33,103,636 |
| Fuel | $5,615,465 | $2,109,832 | $551,499 | $223,621 | $127,480 | $1,342,396 | $460,896 | $799,741 |
| Rent of power and heat | $18,961 | | $360 | | | $18,076 | | $525 |
| Mill supplies | $947,279 | $294,196 | $9,942 | $25,188 | $5,270 | $334,047 | $62,783 | $215,903 |
| All other materials | $4,766,604 | $238,509 | $32,500 | $65,529 | $119,941 | $1,390,041 | $2,391,132 | $528,952 |
| Freight | $2,720,213 | $171,358 | $3,045 | | | $2,401,544 | | $144,266 |
| Products: | | | | | | | | |
| Aggregate value | $165,131,670 | $17,286,517 | $4,508,259 | $3,893,034 | $17,340,041 | $36,387,063 | $38,365,131 | $47,351,625 |
| Smelting— | | | | | | | | |
| Total value | $54,275,173 | $17,238,980 | $4,508,259 | $3,893,034 | | $22,269,979 | $679,000 | $5,685,921 |
| Fine copper contents of blister or anodes— | | | | | | | | |
| Pounds | 197,056,734 | 75,127,116 | 84,000 | | | 112,775,861 | 2,930,000 | 6,139,757 |
| Value | $25,853,917 | $9,663,907 | $12,474 | | | $14,817,260 | $440,000 | $920,276 |
| Fine copper contents of matte— | | | | | | | | |
| Pounds | 137,622,709 | 52,832,952 | 25,863,637 | 21,212,797 | | 24,492,199 | | 13,221,124 |
| Value | $17,511,130 | $6,801,515 | $3,334,490 | $1,993,791 | | 3,254,766 | | $1,626,568 |
| Silver— | | | | | | | | |
| Ounces fine | 8,866,472 | 711,373 | 427,315 | 728,334 | | 6,032,031 | 301,800 | 665,619 |
| Value | $5,020,050 | $411,016 | $227,035 | $428,493 | | $3,412,340 | $170,000 | $371,166 |
| Gold— | | | | | | | | |
| Ounces fine | 300,914 | 18,074 | 23,328 | 71,396 | | 45,781 | 3,453 | 138,882 |
| Value | $5,890,076 | $362,542 | $434,260 | $1,470,750 | | $785,613 | $69,000 | $2,767,911 |
| Received for contract work[3] | $293,961 | | $280 | | | $282,464 | | $11,217 |
| Refining— | | | | | | | | |
| Total value | $107,635,247 | $47,537 | | | $17,340,041 | $14,117,084 | $35,149,583 | $40,981,002 |
| Ingots, wire, bars, etc.— | | | | | | | | |
| Pounds | 602,595,113 | | | | 102,001,189 | 95,404,468 | 170,326,925 | 234,862,531 |
| Value | $94,061,667 | | | | $17,340,041 | $12,190,564 | $27,432,652 | $37,098,410 |
| Blue vitriol— | | | | | | | | |
| Pounds | 27,298,926 | 1,281,313 | | | | | 1,818,272 | 24,199,341 |
| Value | $1,225,745 | $47,537 | | | | | $91,413 | $1,086,795 |
| Silver— | | | | | | | | |
| Ounces fine | 13,229,911 | | | | | 3,026,888 | 7,594,285 | 2,608,738 |
| Value | $7,790,985 | | | | | $1,714,278 | $4,586,730 | $1,539,977 |
| Gold— | | | | | | | | |
| Ounces fine | 224,352 | | | | | 10,612 | 150,949 | 62,791 |
| Value | $4,556,850 | | | | | $212,242 | $3,088,788 | $1,255,820 |
| All other products | $3,221,250 | | | | | | $2,536,548 | $684,702 |
| Received for contract work[3] | $3,452,855 | | | | $346,287 | | $1,035,654 | $2,070,914 |
| Power: | | | | | | | | |
| Number of establishments reporting | 47 | 9 | 3 | 3 | 3 | 7 | 7 | 15 |
| Total horsepower, owned | 66,242 | 6,211 | 1,520 | 1,065 | 930 | 34,350 | 8,952 | 13,214 |
| Engines— | | | | | | | | |
| Steam— | | | | | | | | |
| Number | 406 | 58 | 12 | 15 | 15 | 177 | 31 | 98 |
| Horsepower | 48,126 | 5,285 | 1,182 | 825 | 870 | 20,200 | 8,320 | 11,444 |
| Gas or gasoline— | | | | | | | | |
| Number | 8 | 6 | 1 | | | | | 1 |
| Horsepower | 337 | 326 | 3 | | | | | 8 |
| Water wheels— | | | | | | | | |
| Number | 29 | 2 | 4 | 1 | 4 | 15 | | 3 |
| Horsepower | 9,467 | 120 | 335 | 120 | 60 | 8,750 | | 82 |
| Electric motors— | | | | | | | | |
| Number | 212 | 28 | | 3 | | 68 | 58 | 55 |
| Horsepower | 4,612 | 480 | | 120 | | 1,700 | 632 | 1,680 |
| Other power, horsepower | 3,700 | | | | | 3,700 | | |
| Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | | | | |
| Total number of establishments | 47 | 9 | 3 | 3 | 3 | 7 | 7 | 15 |
| 5 to 20 | 1 | | | | | | | 1 |
| 21 to 50 | 8 | 2 | 2 | | | | 1 | 3 |
| 51 to 100 | 7 | 3 | | 1 | 1 | | | 2 |
| 101 to 250 | 15 | | | 1 | 2 | 1 | 4 | 7 |
| 251 to 500 | 8 | 3 | 1 | 1 | | 3 | | |
| 501 to 1,000 | 6 | 1 | | | | 1 | 2 | 2 |
| Over 1,000 | 2 | | | | | 2 | | |

[1] This report is for the calendar year 1899.

[2] Includes establishments distributed as follows: Connecticut, 2; Illinois, 1; Maryland, 1; Nevada, 1; New Mexico, 1; New York, 2; Ohio, 1; South Dakota, 1; Tennessee, 1; Utah, 2; Virginia, 1; Washington, 1.

[3] The amount of this contract work is distributed among the various items to which it properly belongs, and is not, therefore, included in the value of the products as a single item.

# ZINC, SMELTING.

The zinc smelting industry has grown very rapidly in recent years, an almost constant annual increase having been maintained from the earliest development of the industry. During the census year ending May 31, 1880, the production of spelter was 23,239 short tons. The census statistics for 1890, which cover the calendar year 1889, revealed an increase to 58,860 short tons. During the last decade the output has again more than doubled, reaching a total of 131,546 short tons during the calendar year 1899, this including the production of sheet zinc.

Table 27 is a summary by states of the statistics reported under the general heads of the inquiry.

TABLE 27.—ZINC, SMELTING: SUMMARY FOR THE UNITED STATES, 1900.[1]

| | United States. | Illinois. | Indiana. | Kansas. | Missouri. | Pennsylvania. | All other states.[2] |
|---|---|---|---|---|---|---|---|
| Number of establishments | 31 | 5 | 3 | 11 | 5 | 3 | 4 |
| Capital | $14,141,810 | $3,186,319 | $144,895 | $5,218,529 | $804,029 | $1,571,026 | $2,916,472 |
| Land | $2,243,876 | $138,100 | $7,250 | $1,684,026 | $25,500 | $59,000 | $330,000 |
| Buildings | $5,470,590 | $637,434 | $108,454 | $2,206,702 | $288,000 | $1,150,000 | $1,080,000 |
| Machinery, tools, and implements | $1,935,754 | $1,095,041 | $21,690 | $405,464 | $77,300 | $190,000 | $146,259 |
| Cash and sundries | $4,491,590 | $1,315,744 | $7,441 | $922,337 | $413,229 | $472,026 | $1,360,213 |
| Salaried officials, clerks, etc., number | 208 | 80 | 8 | 40 | 17 | 9 | 54 |
| Salaries | $440,200 | $222,022 | $7,650 | $60,800 | $36,880 | $13,669 | $99,179 |
| Wage-earners, average number | 4,869 | 1,551 | 119 | 1,487 | 500 | 448 | 764 |
| Total wages | $2,355,921 | $758,912 | $58,138 | $705,803 | $268,196 | $174,510 | $390,362 |
| Miscellaneous expenses | $399,472 | $109,407 | $5,588 | $81,169 | $36,903 | $4,869 | $161,586 |
| Cost of materials used | $13,286,058 | $4,416,815 | $387,399 | $4,678,946 | $1,651,387 | $896,192 | $1,255,319 |
| Value of products | $18,188,498 | $5,882,746 | $445,643 | $5,790,144 | $2,011,724 | $1,521,307 | $2,536,934 |

[1] This report is for the calendar year 1899. [2] Includes establishments distributed as follows: New Jersey, 2; Virginia, 1; Wisconsin, 1.

The products of the metallurgy of zinc in the United States have become so varied and are so interlaced that it is impossible to present separately the statistics relating to spelter, to the rolling of sheet zinc, and to the manufacture of zinc white from the ore. In Table 27 the total value of the products is given. In addition to the 31 active establishments shown in the foregoing table, there were 2 idle establishments with a capital of $59,500; 1 located in Kansas and 1 in Virginia.

Table 28 presents separately the statistics of establishments east and west of the Mississippi River.

TABLE 28.—ZINC SMELTING ESTABLISHMENTS, BY LOCATION, EAST AND WEST OF THE MISSISSIPPI RIVER: 1900.[1]

| | Total. | East of the Mississippi. | West of the Mississippi. |
|---|---|---|---|
| Number of establishments | 31 | 15 | 16 |
| Capital | $14,141,810 | $8,119,252 | $6,022,558 |
| Salaried officials, clerks, etc., number | 208 | 151 | 57 |
| Salaries | $440,200 | $342,520 | $97,680 |
| Wage-earners, average number | 4,869 | 2,882 | 1,987 |
| Total wages | $2,355,921 | $1,381,922 | $973,999 |
| Miscellaneous expenses | $399,472 | $281,400 | $118,072 |
| Materials used: | | | |
| Total cost | $13,286,058 | $6,955,725 | $6,330,333 |
| Ore— | | | |
| Short tons | 463,609 | 289,618 | 173,991 |
| Cost | $10,995,846 | $5,174,548 | $5,821,298 |
| Dross— | | | |
| Short tons | 12,578 | 12,578 | ..... |
| Cost | $644,645 | $644,645 | ..... |
| All other materials | $1,645,567 | $1,136,532 | $509,035 |
| Products: | | | |
| Total value | $18,188,498 | $10,386,630 | $7,801,868 |
| Spelter— | | | |
| Pounds | 227,046,314 | 82,401,099 | 145,245,215 |
| Value | $12,348,036 | $4,546,168 | $7,801,868 |
| Zinc oxide— | | | |
| Pounds | 75,114,904 | 75,114,904 | ..... |
| Value | $2,718,700 | $2,718,700 | ..... |
| Sheet zinc— | | | |
| Pounds | 35,445,374 | 35,445,374 | ..... |
| Value | $2,495,380 | $2,495,380 | ..... |
| Sulphuric acid— | | | |
| Pounds | 117,655,214 | 117,655,214 | ..... |
| Value | $424,670 | $424,670 | ..... |
| All other products, value | $201,712 | $201,712 | ..... |

[1] This report is for the calendar year 1899.

Table 28 shows that while the greater tonnage of spelter is made west of the Mississippi River, the total value of all products is greater in the territory east of the Mississippi.

Table 29 shows the statistics of zinc smelting by groups of states, Illinois, Indiana, Kansas, Missouri, and Wisconsin comprising one group, and New Jersey, Pennsylvania, and Virginia the other.

TABLE 29.—ZINC SMELTING ESTABLISHMENTS ARRANGED ACCORDING TO LOCATION: 1900.[1]

| | Total. | Illinois, Indiana, Kansas, Missouri, and Wisconsin. | New Jersey, Pennsylvania, and Virginia. |
|---|---|---|---|
| Number of establishments | 31 | 25 | 6 |
| Capital | $14,141,810 | $9,948,712 | $4,193,098 |
| Salaried officials, clerks, etc., number | 208 | 160 | 48 |
| Salaries | $440,200 | $351,532 | $88,668 |
| Wage-earners, average number | 4,869 | 3,789 | 1,080 |
| Total wages | $2,355,921 | $1,849,663 | $506,258 |
| Miscellaneous expenses | $399,472 | $242,147 | $157,325 |
| Materials used: | | | |
| Total cost | $13,286,058 | $11,486,743 | $1,799,315 |
| Ore— | | | |
| Short tons | 463,609 | 300,150 | 163,459 |
| Cost | $10,995,846 | $10,106,027 | $889,819 |
| Dross— | | | |
| Short tons | 12,578 | 2,427 | 10,151 |
| Cost | $644,645 | $124,340 | $520,305 |
| All other materials | $1,645,567 | $1,256,376 | $389,191 |
| Products: | | | |
| Total value | $18,188,498 | $14,636,168 | $3,552,330 |
| Spelter— | | | |
| Pounds | 227,046,314 | 210,035,578 | 17,010,736 |
| Value | $12,348,036 | $11,151,891 | $1,196,145 |
| Zinc oxide— | | | |
| Pounds | 75,114,904 | 14,879,750 | 60,235,154 |
| Value | $2,718,700 | $505,911 | $2,212,789 |
| Sheet zinc— | | | |
| Pounds | 35,445,374 | 35,445,374 | ..... |
| Value | $2,495,380 | $2,495,380 | ..... |
| Sulphuric acid— | | | |
| Pounds | 117,655,214 | 117,655,214 | ..... |
| Value | $424,670 | $424,670 | ..... |
| All other products, value | $201,712 | $58,316 | $143,396 |

[1] This report is for the calendar year 1899.

The zinc industry of the United States is naturally divided into two main groups, presented in Table 29. The first includes the works of Illinois, Indiana, Kansas, Missouri, and Wisconsin, and is dependent almost exclusively upon the ores mined in the Mississippi Valley, all the works purchasing their ores in the open market.

The second group includes the works of Pennsylvania, New Jersey, and Virginia, which control nearly the whole of their own ore supply. While the western works make only what is known as "common spelter," the eastern plants produce a special grade which commands a higher price at home and abroad. The first group reports the actual price paid for ore in the open market, while the latter can not do more than place upon the raw material consumed an arbitrary estimate of its cost at the smelter.

Table 30 is a comparative statement for the United States of statistics reported for 1889[1] and 1899, with the percentages of increase of 1899 over 1889.

TABLE 30.—ZINC, SMELTING: COMPARATIVE SUMMARY FOR THE UNITED STATES, 1889 AND 1899, WITH PER CENT OF INCREASE.

| | 1899 | 1889 | Per cent of increase. |
|---|---|---|---|
| Number of establishments | 31 | 21 | 47.6 |
| Capital, total value | $14,141,810 | $4,469,386 | 216.4 |
| Land | $2,243,876 | $613,000 | 266.0 |
| Buildings | $5,470,590 | $2,019,915 | 170.8 |
| Machinery, tools, and implements | $1,935,754 | $975,856 | 98.4 |
| Cash and sundries | $4,491,590 | $860,615 | 421.9 |
| Salaried officials, clerks, etc., number | 208 | 95 | 118.9 |
| Salaries | $440,200 | $140,280 | 213.8 |
| Wage-earners, average number | 4,869 | 2,690 | 81.0 |
| Total wages | $2,355,921 | $1,424,981 | 65.3 |
| Miscellaneous expenses | $399,472 | $226,232 | 76.6 |
| Materials used: | | | |
| Total cost | $13,286,058 | $4,807,710 | 176.3 |
| Ores— | | | |
| Short tons | 463,609 | 196,309 | 136.2 |
| Cost | $10,995,846 | $4,154,404 | 164.7 |
| All other materials, cost | $2,290,212 | $653,306 | 250.6 |
| Products | | | |
| Spelter, short tons | [1]131,546 | [1]58,860 | 123.5 |
| Zinc oxide, short tons | 37,557 | 16,970 | 121.3 |

[1] Includes sheet zinc manufactured at smelter.

The statistics for 1889 in Table 30 are taken from the Eleventh Census report on Mines and Mining, the data in the report for manufactures being too incomplete for purposes of comparison.

The methods of inquiry employed at the two census periods differed in several particulars, and the foregoing table presents as accurate a comparison of the items common to both censuses as it is possible to make from the results obtained.

It is a noteworthy fact that the capital invested has increased largely during the decade which has elapsed. This is principally due to the development of collateral industries like the rolling of sheet zinc, which increased from 9,389 short tons in 1889 to 17,723 short tons in 1899, and to the introduction since 1889 of the manufacture of sulphuric acid and acid phosphate, two products which are the result of utilizing sulphurous acid made in roasting blende. In 1899 there were produced 58,828 tons of sulphuric acid and 7,512 tons of acid phosphate.

[1] Report on Mineral Industries, Eleventh Census, page 174.

The capital account of zinc smelting works has also been increased materially by the adoption of improved appliances, notably by the automatic calcining furnaces which have been successfully introduced in recent years.

Geographically, the industry has shifted considerably. Kansas, which stood second in 1889, with a product of 13,658 net tons of spelter, has risen to first rank, with a production of 54,516 short tons in 1899. Illinois, with a joint production of spelter and sheet zinc of 23,860 short tons in 1889, has fallen to second place in 1899, with 45,759 short tons of spelter and sheet zinc. Indiana, which was not a spelter-producing state in 1889, has become the seat of several plants as the result of the manufacturing advantages following the discovery of natural gas.

An interesting and significant movement has taken place in recent years in the districts close to the famous Joplin-Galena ore fields. Before the discovery of the Kansas natural gas belt the ores were worked at plants located either in the immediate vicinity of the ore mines, or in the Kansas coal field, or close to coal in the Chicago district, or finally at the principal primary market for the metal, St. Louis. A very rapid change followed the successful drilling for natural gas at Iola, Cherryvale, and adjacent points in Kansas, large works being located in this district to take advantage of the cheap and metallurgically advantageous fuel. Of course, being modern, they embody the experience of men long identified with the industry, and familiar with local conditions. The disadvantages under which the older works labor have been further emphasized by forced intermittent work. Therefore, the mere change of fuel does not account for the entire difference in results shown. The following statistics, compiled from a number of the individual reports, give numerical expression to these facts:

*Zinc Works Using Natural Gas.*

| | Spelter produced, short tons. | Wages per short ton. | Fuel per short ton. |
|---|---|---|---|
| Kansas belt | 40,125 | $12.03 | $1.38 |
| Indiana belt | 4,359 | 13.34 | 2.99 |

*Zinc Works Using Coal.*

| | | | |
|---|---|---|---|
| Kansas and southwestern Missouri | 24,219 | $15.53 | $4.19 |
| St. Louis district | 14,151 | 14.06 | 5.68 |

It is impossible to present in this statement the figures for the Chicago district, including Lasalle and Peru, Ill., because the majority of the plants manufacture a number of other products.

It will be observed that for the Kansas works using

gas the fuel cost of spelter is very low; that in the Indiana belt it is higher; that the local fuel of the Kansas-Missouri plants using coal permits of somewhat cheaper work than that of the local coals of the St. Louis district. The latter, of course, pay for a relatively long haul on the ore, but as an offset against this is their location at the most important market for spelter and greater proximity to the consumer.

The higher labor cost of the Kansas and Missouri coal plants as compared with that of the works in the Kansas natural-gas belt is readily explained by the fact that all the latter plants are modern, while many of the former are old and some of them antiquated.

A striking fact in connection with the condition of the zinc-smelting industry is the enormous rise in prices of ore which took place, for a brief period, in the year 1899, which thus represents exceptional conditions. The price for zinc ore of standard quality in the bins at the mine reached $55 per short ton in May, and the average price for the year was $38.50, against $28.44 in 1898 and $22.28 in 1897. The returns from the smelters in Kansas, Missouri, Illinois, Wisconsin, and Indiana show that the cost to them of the 300,150 tons of zinc ore smelted in 1899 was $33.67 per ton, which, however, includes the freight to distant plants. In the census year 1889, in the same districts, 128,716 tons of ore treated averaged $26.59 per ton. This, in both cases, includes the silicate ores, which sell on a different basis than the blende, relatively far the most important quantity smelted. The rapid fluctuations in the price of ores and the high average range of value have made the year 1899 an abnormal one.

Table 31 shows the quantities of the several products manufactured, by states and for the United States.

TABLE 31.—PRODUCTS BY STATES: 1900.[1]

| STATES. | Spelter. | Zinc oxide. | Sheet zinc. | Sulphuric acid. |
|---|---|---|---|---|
| | *Pounds.* | *Pounds.* | *Pounds.* | *Pounds.* |
| United States | 227,646,314 | 75,114,904 | 35,445,374 | 117,655,214 |
| Illinois | 56,071,801 | | 35,445,374 | 117,655,214 |
| Indiana | 8,718,562 | | | |
| Kansas | 109,031,032 | | | |
| Missouri | 36,213,583 | | | |
| New Jersey | | 40,946,186 | | |
| Pennsylvania | 9,562,852 | 19,288,968 | | |
| Virginia | 8,047,884 | | | |
| Wisconsin | | 14,879,750 | | |

[1] This report is for the calendar year 1899.

The total production of zinc metal in the United States, obtained by adding the output of spelter, shown in Table 31, to that of sheet zinc, is 263,091,688 pounds, or 131,546 tons.

The detailed statistics for the industry as reported are shown in Table 32. This table presents separate totals for each state in which there were 3 or more establishments, and groups the statistics for other states so as not to disclose the operations of individual establishments. The establishments are classified according to the character of the ownership, which shows that 3 were owned by individuals, 2 by partnerships, and 26 by corporations. The employees are segregated so as to show for salaried officers and wage-earners separately the number and salaries or wages of men, women, and children, respectively, and also the average number of wage-earners employed during each month of the year. Separate totals of the different materials and products are shown. The number of engines and electric motors in use and their horsepower are presented, and the 31 establishments are grouped according to the number of employees in each.

TABLE 32.—ZINC, SMELTING, BY STATES: 1900.[1]

| | United States. | Illinois. | Indiana. | Kansas. | Missouri. | Pennsylvania. | All other states.[2] |
|---|---|---|---|---|---|---|---|
| Number of establishments | 31 | 5 | 3 | 11 | 5 | 3 | 4 |
| Character of organization: | | | | | | | |
| Individual | 3 | | 1 | 1 | 1 | | |
| Firm and limited partnership | 2 | | | 2 | | | |
| Incorporated company | 26 | 5 | 2 | 8 | 4 | 3 | 4 |
| Capital: | | | | | | | |
| Total | $14,141,810 | $3,186,319 | $144,835 | $5,218,529 | $804,029 | $1,871,626 | $2,916,472 |
| Land | $2,243,876 | $138,100 | $7,250 | $1,684,026 | $25,500 | $59,000 | $330,000 |
| Buildings | $5,470,590 | $637,434 | $108,454 | $2,206,702 | $288,000 | $1,150,000 | $1,080,000 |
| Machinery, tools, and implements | $1,935,754 | $1,095,041 | $21,690 | $405,464 | $77,300 | $190,000 | $146,259 |
| Cash and sundries | $4,491,590 | $1,315,744 | $7,141 | $922,337 | $413,229 | $472,626 | $1,360,213 |
| Proprietors and firm members | 4 | | 1 | 2 | 1 | | |
| Salaried officials, clerks, etc.: | | | | | | | |
| Total number | 208 | 80 | 8 | 40 | 17 | 9 | 54 |
| Total salaries | $440,200 | $222,022 | $7,650 | $60,800 | $36,880 | $13,669 | $99,179 |
| Officers of corporations— | | | | | | | |
| Number | 41 | 11 | 4 | 3 | 3 | | 20 |
| Salaries | $193,275 | $92,775 | $4,800 | $18,400 | $20,800 | | $56,500 |
| General superintendents, managers, clerks, etc— | | | | | | | |
| Total number | 167 | 69 | 4 | 37 | 14 | 9 | 34 |
| Total salaries | $246,925 | $129,247 | $2,850 | $42,400 | $16,080 | $13,669 | $42,679 |
| Men— | | | | | | | |
| Number | 163 | 68 | 3 | 37 | 14 | 9 | 32 |
| Salaries | $245,521 | $128,623 | $2,550 | $42,400 | $16,080 | $13,669 | $42,199 |
| Women— | | | | | | | |
| Number | 4 | 1 | 1 | | | | 2 |
| Salaries | $1,404 | $624 | $300 | | | | $480 |
| Wage-earners, including pieceworkers, and total wages: | | | | | | | |
| Greatest number employed at any one time during the year | 5,944 | 1,641 | 190 | 1,958 | 537 | 751 | 867 |
| Least number employed at any one time during the year | 4,473 | 1,476 | 140 | 1,186 | 433 | 593 | 645 |
| Average number | 4,869 | 1,551 | 119 | 1,487 | 500 | 448 | 764 |
| Wages | $2,355,921 | $758,912 | $58,138 | $705,803 | $268,196 | $174,510 | $390,362 |
| Men, 16 years and over— | | | | | | | |
| Average number | 4,843 | 1,533 | 119 | 1,485 | 500 | 448 | 758 |
| Wages | $2,348,338 | $754,698 | $58,138 | $704,903 | $268,196 | $174,510 | $387,893 |

[1] This report is for the calendar year 1899.

[2] Includes establishments distributed as follows: New Jersey, 2; Virginia, 1; Wisconsin, 1.

TABLE 32.—ZINC, SMELTING, BY STATES: 1900—Continued.[1]

| | United States. | Illinois. | Indiana. | Kansas. | Missouri. | Pennsylvania. | All other states.[2] |
|---|---|---|---|---|---|---|---|
| Wage-earners, including pieceworkers, and total wages—Continued. | | | | | | | |
| Wages—Continued. | | | | | | | |
| Women, 16 years and over— | | | | | | | |
| Average number | 3 | | | 2 | | | 6 |
| Wages | $3,369 | | | $900 | | | $2,469 |
| Children, under 16 years— | | | | | | | |
| Average number | 18 | 18 | | | | | |
| Wages | $4,214 | $4,214 | | | | | |
| Average number of wage-earners, including pieceworkers, employed during each month: | | | | | | | |
| Men, 16 years and over— | | | | | | | |
| January | 4,559 | 1,491 | 92 | 1,426 | 517 | 383 | 650 |
| February | 4,764 | 1,510 | 102 | 1,532 | 532 | 378 | 710 |
| March | 5,035 | 1,533 | 107 | 1,732 | 530 | 385 | 748 |
| April | 5,012 | 1,535 | 109 | 1,726 | 524 | 382 | 736 |
| May | 5,138 | 1,546 | 164 | 1,762 | 535 | 392 | 739 |
| June | 5,120 | 1,540 | 190 | 1,740 | 501 | 407 | 742 |
| July | 5,022 | 1,561 | 182 | 1,626 | 489 | 432 | 732 |
| August | 4,829 | 1,580 | 182 | 1,380 | 477 | 446 | 764 |
| September | 4,728 | 1,565 | 145 | 1,331 | 474 | 417 | 796 |
| October | 4,548 | 1,542 | 87 | 1,221 | 467 | 404 | 827 |
| November | 4,674 | 1,488 | 33 | 1,147 | 470 | 711 | 825 |
| December | 4,687 | 1,500 | 31 | 1,202 | 487 | 642 | 825 |
| Women, 16 years and over— | | | | | | | |
| January | 7 | | | 2 | | | 5 |
| February | 7 | | | 2 | | | 5 |
| March | 7 | | | 2 | | | 5 |
| April | 7 | | | 2 | | | 5 |
| May | 7 | | | 2 | | | 5 |
| June | 8 | | | 2 | | | 6 |
| July | 9 | | | 2 | | | 7 |
| August | 8 | | | 2 | | | 6 |
| September | 9 | | | 2 | | | 7 |
| October | 9 | | | 2 | | | 7 |
| November | 9 | | | 2 | | | 7 |
| December | 9 | | | 2 | | | 7 |
| Children, under 16 years— | | | | | | | |
| January | 9 | 9 | | | | | |
| February | 10 | 10 | | | | | |
| March | 11 | 11 | | | | | |
| April | 15 | 15 | | | | | |
| May | 16 | 16 | | | | | |
| June | 13 | 13 | | | | | |
| July | 18 | 18 | | | | | |
| August | 21 | 21 | | | | | |
| September | 25 | 25 | | | | | |
| October | 27 | 27 | | | | | |
| November | 25 | 25 | | | | | |
| December | 26 | 26 | | | | | |
| Miscellaneous expenses— | | | | | | | |
| Total | $399,472 | $109,407 | $5,588 | $81,169 | $36,903 | $4,869 | $161,536 |
| Rent of works | $10,200 | | | $7,800 | $2,400 | | |
| Taxes, not including internal revenue | $44,481 | $12,033 | $394 | $11,023 | $2,883 | $1,935 | $16,213 |
| Rent of offices, insurance, interest, and all sundry expenses not hitherto included | $344,791 | $97,374 | $5,194 | $62,346 | $31,620 | $2,934 | $145,323 |
| Materials used: | | | | | | | |
| Total cost | $13,286,058 | $4,416,815 | $387,399 | $4,678,946 | $1,651,387 | $896,192 | $1,255,319 |
| Ore— | | | | | | | |
| Short tons | 463,609 | 92,400 | 10,359 | 131,407 | 42,584 | 45,627 | 141,232 |
| Cost | $10,995,846 | $3,669,953 | $326,691 | $4,317,628 | $1,503,670 | $262,792 | $915,112 |
| Dross— | | | | | | | |
| Short tons | 12,578 | 2,427 | | | | 9,569 | 582 |
| Cost | $644,645 | $124,340 | | | | $506,242 | $14,063 |
| Fuel | $751,839 | $261,661 | $8,058 | $129,173 | $93,534 | $66,591 | $192,822 |
| Rent of power and heat | $75,000 | | | $75,000 | | | |
| Mill supplies | $93,845 | $24,977 | $1,145 | $10,452 | $2,412 | $14,962 | $20,897 |
| All other materials | $436,378 | $205,538 | $6,836 | $41,103 | $33,871 | $45,605 | $103,425 |
| Freight | $298,505 | $130,346 | $44,669 | $105,590 | $17,900 | | |
| Products: | | | | | | | |
| Total value | $18,188,498 | $5,882,746 | $445,643 | $5,790,144 | $2,011,724 | $1,521,307 | $2,530,934 |
| Spelter— | | | | | | | |
| Pounds | 227,646,314 | 56,071,801 | 8,718,562 | 109,031,632 | 36,213,583 | 9,562,852 | 8,047,884 |
| Value | $12,348,036 | $2,904,380 | $445,643 | $5,790,144 | $2,011,724 | $660,598 | $535,547 |
| Zinc oxide— | | | | | | | |
| Pounds | 75,114,904 | | | | | 19,288,968 | 55,825,936 |
| Value | $2,718,700 | | | | | $779,672 | $1,939,028 |
| Sheet zinc— | | | | | | | |
| Pounds | 35,445,374 | 35,445,374 | | | | | |
| Value | $2,495,380 | $2,495,380 | | | | | |
| Sulphuric acid— | | | | | | | |
| Pounds | 117,655,214 | 117,655,214 | | | | | |
| Value | $424,670 | $424,670 | | | | | |
| Value of all other products | $201,712 | $58,316 | | | | $81,037 | $62,359 |
| Power: | | | | | | | |
| Number of establishments reporting | 31 | 5 | 3 | 11 | 5 | 3 | 4 |
| Total horsepower | 12,546 | 3,294 | 230 | 2,330 | 675 | 3,921 | 2,096 |
| Owned— | | | | | | | |
| Engines— | | | | | | | |
| Steam— | | | | | | | |
| Number | 127 | 34 | 3 | 41 | 9 | 26 | 14 |
| Horsepower | 11,095 | 3,089 | 220 | 2,265 | 560 | 2,970 | 1,991 |
| Gas or gasoline— | | | | | | | |
| Number | 4 | | 1 | 2 | | | 1 |
| Horsepower | 50 | | 10 | 35 | | | 5 |
| Electric motors— | | | | | | | |
| Number | 60 | 11 | | 3 | 5 | 36 | 5 |
| Horsepower | 1,401 | 205 | | 30 | 115 | 951 | 100 |
| Establishments classified by number of persons employed, not including proprietors and firm members: | | | | | | | |
| Total number of establishments | 31 | 5 | 3 | 11 | 5 | 3 | 4 |
| 21 to 50 | 1 | 1 | | | | | |
| 51 to 100 | 13 | 1 | 3 | 5 | 3 | 1 | |
| 101 to 250 | 11 | 1 | | 5 | 2 | | 3 |
| 251 to 500 | 3 | | | | | 2 | 1 |
| 501 to 1,000 | 3 | 2 | | 1 | | | |

[1] This report is for the calendar year 1899

[2] Includes establishments distributed as follows: New Jersey, 2; Virginia, 1; Wisconsin, 1.